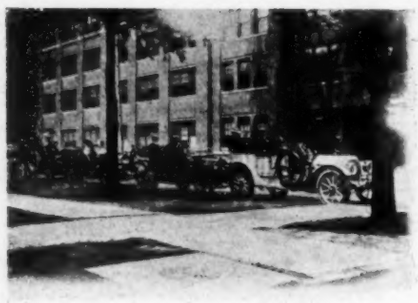
THE AUTOMOBILE

Detroit Extends Welcome to Largest S.A.E. Gathering

DETROIT, July 30—Five years of painstaking effort on the part of the automobile engineers of this country reached a fitting culmination at the Summer meeting which opened on July 28 with headquarters at the Hotel Tuller, and so largely attended that the accommodations of this establishment were far below the demand of the occasion, and many of the visiting engineers sought accommodations at the Pontchartrain, Cadillac, and elsewhere. It would be impossible to say just what the real attendance was. Of the membership proper, perhaps there were no more than 300 of them registered, but the new and aggressive policy of the Society, as laid down by President H. E. Coffin, which is being carried out to the letter by Manager Coker F. Clarkson, has attracted such wide notice that the engineers, who have not heretofore seen fit to ally themselves with the work, found it convenient to journey to Detroit and examine into the situation for themselves. Despite the care with which the programme was prepared, the entertainment committee, comprising President H. E. Coffin (ex officio), H. W. Alden, chairman; George W. Dunham, Russell Huff, H. M. Leland, F. E. Watts, E. T. Birdsall, A. P. Brush, F. H. Floyd, G. M. Holley, and G. E. Merryweather, found ample opportunity to tax its executive ability, which proved adequate for the needs, ending in the largest and most profitable meeting that was ever held by the Society.

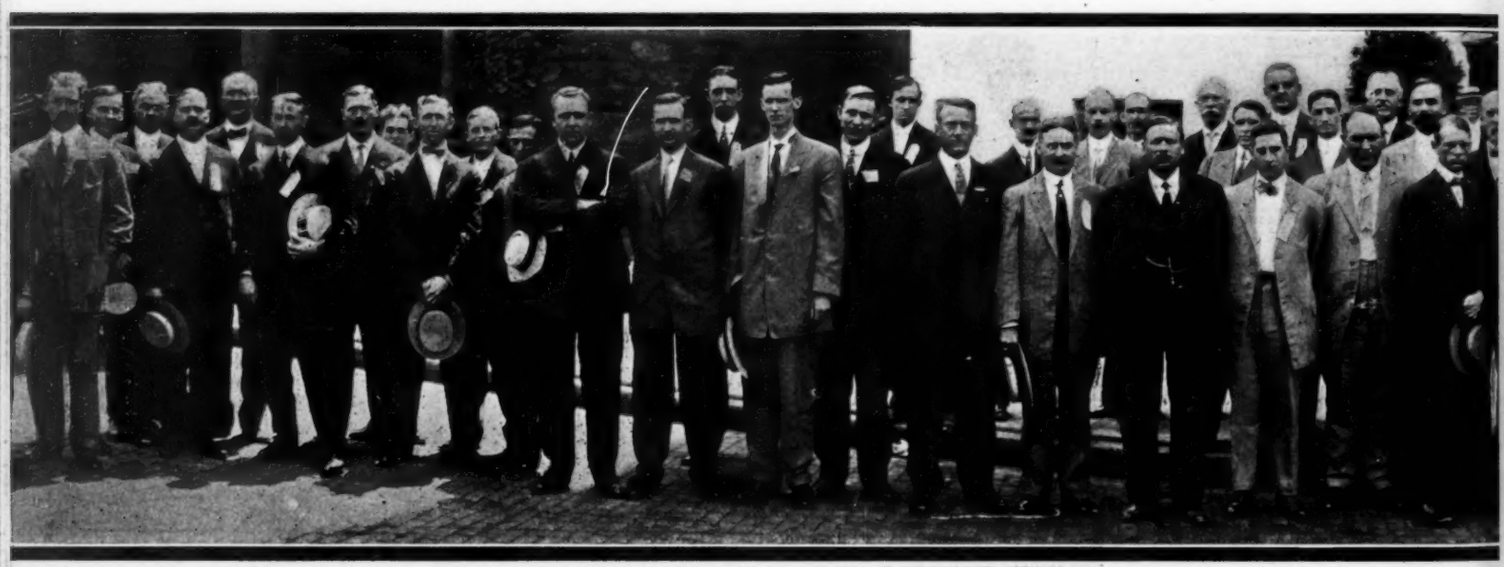
The programme was a large one, including ten set papers, covering extremely important subjects, all of which were read and discussed, excepting a paper in relation to a Franklin air-cooled motor test, which was deferred owing to the absence of Professor Rola C. Carpenter, the idea being to give to this paper the attention it deserves at the next annual meeting of the Society. The papers which were presented and discussed are printed in this issue of THE AUTOMOBILE in somewhat revised form. In addition to the set papers there were a series of discussions on various important phases of the automobile situation, but in addition to the formal discussion indulged in there were many informal talks and comparisons of notes that will go far to unravel the tangle that stands in the way of further refinement of the more advanced problems leading to finality in the automobile art.

Experience has shown that formal discussion of papers presented is very meagre, as a rule, and oftentimes the most pertinent points are brought out at informal gatherings of groups of the members after the meeting. As an illustration of this phase of the situation the matter referred to in the paper entitled "The Specification and Heat-treatment of Automobile Materials," by Henry Souther, will serve very well. In Mr. Souther's paper it was pointed out by him that a single type of steel, if heat-treated in view of the work to be done, might serve for all the purposes to which steel is put in the building of automobiles. Mr. Souther pointed out that the modulus of elasticity is scarcely different for the hardest alloy steel as compared with mild steel. He said that the only reason for using a higher type of steel than that presented in a Bessemer bar for crankshaft work is represented in the difference between the elastic limits of the respective products. Attention was called to ore from Cuba, that is said to be rich in nickel and chromium. Mr. Souther claimed that this ore carried about 1 per cent. nickel and about 4-10 of 1 per cent. chromium. Informal discussions involving this material brought out two or three points that will have to be reckoned with in the long run, among which is the fact that the



The crowd at the E-M-F factory

chromium content of this ore is apparently not relied upon as sufficiently near the point named to make it possible for fabricators of steel to claim that it would be a nickel-chrome steel product. It is even a question, according to some debaters, as to whether or not the nickel content is reasonably constant. Other engineers raised the question as to the efficacy of 1 per cent. nickel in steel, and some were quite positive in their declaration to the effect that 4-10 of 1 per cent. chromium is of small value, while one metallurgist pointed out that one of the big steel companies, in coping with this particular ore, "blew" the chromium because they had no use for it. There was one other point brought out by Mr. Souther which raised quite a little discussion, some of it formal, but for the most part in an informal way. It was claimed that open-hearth steel is relatively a poor product, and that it would be very capable were it to compare favorably with crucible steel. What Mr. Souther intended to convey apparently was the impression that crucible steel is a sort of "micrometer" to be used as a gauge or measure to go by in rating steel in general. Mr. Souther did not have the undivided support of the members present, and the metallurgists who were willing to express an opinion on the subject made it quite plain that a crucible pot cannot serve as an instrument of precision in gauging the quality of steel, due to the fact that good steel cannot be made by this process unless good raw materials are employed therein. It is generally admitted that the crucible process, despite its faults, is capable of great things, but there is no way known to the art by which the carbon of which the crucible is made can be kept out of the steel, nor is it possible to tell with accuracy how much of the carbon of which the pot is made will be absorbed in the steel. The average automobile engineer, in selecting crucible steel for his work, favors the contention that the carbon is likely to be relatively high, and regrets that he cannot be sure that it will be uniformly present. It is not believed that Mr. Souther carried conviction on this point. There is one other matter that came out in this particular paper that did not find favor. Mr. Souther said it was an old-fashioned idea to contend that in the process of cementation it was necessary to use low-carbon steel. He seemed to think that automobile engineers generally labored under the impression that 50 carbon steel could not be cemented. It was pointed out by some of the members present that there was nothing old-fashioned about the ideas of automobile engineers as they are constituted; they realize perfectly that carbon can be added by the cementing process even up to the point of saturation, and that if the steel, when it is subjected to the cementing process, is not up to the point of saturation more carbon will be taken up. The great question in automobile work is to pursue a safe plan, and safety lies in using a true grade of cementing steel in which the carbon content is below 16 points. Failure comes when the carbon in the core of the cemented section is relatively high, but no matter how low the carbon may be in the core, the shell will have the requisite quantity thereof as a result of cementing. It was the consensus of opinion of such of the members as favored discussion, that it is very necessary to standardize steel and to arrive at more definite conclusions, but they did not take kindly to the idea that it has to be crucible steel, or that heat-treatment will serve in the capacity of a cure-all in the absence of good steel.



At the Timken-Detroit Axle Co.

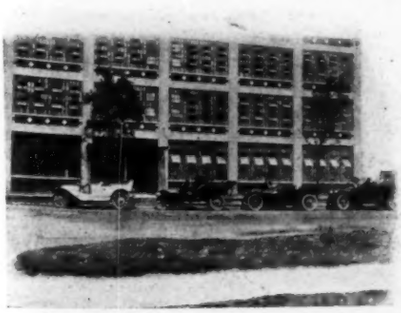
Testing the hardness of metals is a subject that attracted much notice, and was very aptly presented by F. A. Shore in his paper descriptive of the Scleroscope. The instrument in question has been quite considerably exploited in the literature of the subject for some little time, so that the main points in the discussion that took place

At Detroit Steel Products Co.

will be of more interest here than to present the paper in its entirety. Mr. Shore stated in his paper that the Brinell test is very limited in the conclusions that can be reached with safety. The falling tup hammer as used in the scleroscope is preferred by Mr. Shore, although he fails to explain how one would know the thickness of the shell of a cemented section by any reading that can be taken on this instrument, whereas in the Brinell test a small steel ball is pressed with sufficient force to indent the metal to whatever depth the operator desires, and among other information afforded thereby the thickness of the crust of the cemented section may be ascertained. Discussion brought out a rather peculiar situation which will require elucidation, it being the case, according to one member, that the readings for hardness are not the same when measurements are taken on balls of different sizes. It was stated that in a certain comparative test a ball 1 1-8 inches in diameter measured 100, whereas a ball of the same character of material and subjected to the same treatment measured 60, the only difference being that the latter ball was 1-2 inch in diameter. Against this situation stands the statement of another member who pointed out that the smaller the ball the less difficulty there will be in hardening it, but this statement does not jibe with the readings as above indicated, because the larger ball has the higher reading. It will be necessary to clear up such points as these before engineers will understand completely just what the scleroscope does indicate, although it was quite generally conceded that it has many nice uses in the plant, serving in the capacity of an instrument for quickly making comparative tests.

Visiting the Chalmers plant

The paper by Eugene P. Batzell entitled "Slide, Rotary and Piston Valves Versus Poppet Valves for Gas Engine Service" was received with evident satisfaction, and it proved to be an excellent résumé of the situation as it has developed in automobile work, barring specific reference to the performance of the silent Knight type of motor, and the headway that was made in its exploitation. During discussion, David Ferguson pointed out that adverse criticism of the Knight sliding-sleeve scheme to be effective must overcome the force which is represented by the fact that the Knight type of motor is working extremely well, has proven to be of great advantage to the British Daimler Company and is being taken up by important Continental makers of automobiles, among which are the Panhard in France, Mercedes in Germany, Minerva in Belgium, and others. In response to a direct inquiry in relation to the performance of the Knight motor bearing upon the question of gas performance involving the mean effective pressure, Mr. Ferguson stated that the best indication of the advantage to be derived by water-jacketing the ports is shown by the high mean effective pressure realized, and that the thermal efficiency is high is proven by the fact that the radiator required in conjunction with the Knight motor is relatively small. Mr. H. G. Chatain pointed out that the thermal efficiency of the Knight motor is 23 per cent. and that in his judgment there was no reason why poppet valve types of motors should not deliver a near approach to this stated thermal efficiency. Mr. Chatain was of the opinion that if the shape of the cylinders, degrees of compression, and the other conditions are made to conform to the Knight practice in designing, the results obtained should be the same. In this discussion, however, the point was made that in the Knight type of motor the unjacketed and highly heated valve is done away with; the incoming mixture in the Knight type of motor is kept cool, due to the fact that the ports are water-jacketed, and the other advantage of the Knight type of motor lies in the fact that with two sleeves it is possible to time the motor in any desired way, duplicating the timing



At the Aluminum Castings Co.

At the McCord Company's plant

of the poppet valve system if it is found to be the most advantageous. In discussing the merits of rotary valves, very little information of a positive character was extracted excepting that Mr. Ferguson said that a motor should be known by its performance. He went on to say that poppet types of motors are well known by their performance, which is decidedly good considering the mess of complication involved, and that the Knight type of motor was placed beyond the realm of speculation, due to its well-known good performance. According to this method of reasoning, the other types of motors may properly be judged after they generate a reputation of a substantial character. Mr. Brown, in pointing out that the struggle with other than poppet types of valves was for the purpose of eliminating noise, seemed to think that the undertaking might be carried beyond the necessities of the occasion; as he said, mudguards make noise, underpans rattle, transmission gears clatter, and the whole equipment is prone to become noisy as the road becomes rough, and the speed is increased sufficiently. It was Mr. Brown's contention, under the circumstances, that a little noise from the valve motion would scarcely prove discommoding. Other opinions on this point deprecated Mr. Brown's idea, culminating in an expression which, if re-written, might appear thus: Noise, due to the presence of ill-contrived members in an automobile, can scarcely be regarded as a license to put up with additional noise-producing tendencies. As one member stated, what customers want above everything else is silence of performance.

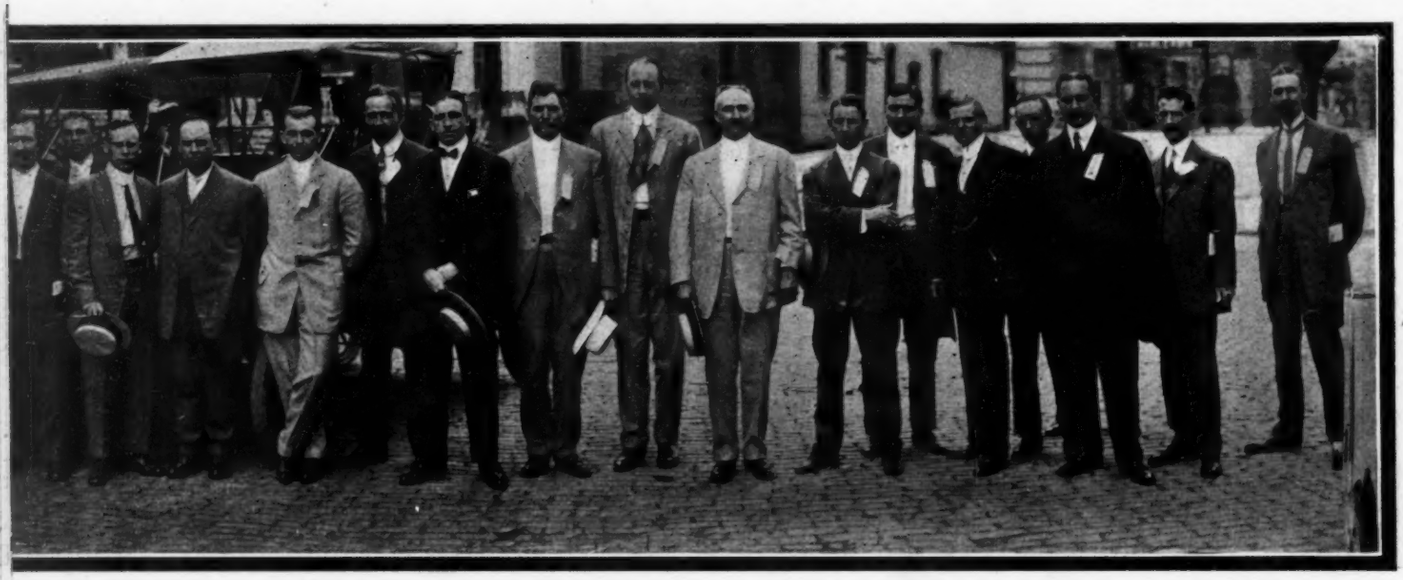
The paper entitled "Motor Trucks for Railroad Service," by T. V. Buckwalter, was interesting to the extent that it pointed out a new field of endeavor which has been worked up to a high state of efficiency, offering additional opportunity to automobile engineers to test their skill and widen the scope for investment.

It is rapidly being realized that the nomenclature of the automobile art is in a sad state of repair, and F. E. Watt at the request of President Coffin fired the first gun in what will probably prove to be a long and distressing task. Mr. Watt's paper, entitled "A Standard Automobile Nomenclature," was limited to a clever statement of the crimes that are being perpetrated daily, and he illustrated by means of a list of assembly groups some of the problems that must be solved in the long run, ending by recommending that a committee be appointed for the purpose of working upon this problem.

The patent situation, which is as acute as ever, was touched upon by E. J. Stoddard, in a paper entitled "The Establishment of a Court of Patent Appeals," which paper was sufficiently broad in scope to discuss the engineer's social relations. This paper adds substantially to the literature of the day, and it bears upon this important subject, bringing out pointedly the fix in which the average inventor finds himself and the fact that a patent is a mere license for a lawsuit. The most conspicuous point made was that a law-abiding citizen finds himself unable to determine whether or not he is infringing on a patent when he makes a machine, nor is he able, by any process of law, to put himself clear upon this point. The recommendation is for a Patent Court of Appeal, with power of last resort, as a proper substitute for 9 or 10 Courts of Appeal, which was said to be the foundation of the confusion that obtains in our present system.

Descriptive of the very latest methods of advance in the manufacture of gears, F. A. Ward presented a paper entitled "Making

(*Continued on page* 205)



This group view was taken by the Packard photographer on arrival at the factory, and a copy given to each participant before departure

Single-Cylinder Motor King at Boulogne

MOST distinctive in the mixed races at Boulogne-sur-Mer was the remarkable showing made by the single-cylinder, 3.9-inch bore, by 10-inch stroke Lion-Peugeot racers in competition against four-cylinder racing cars of very much larger bore. In the one-mile hill climb Boillot, driving one of the long-stroke machines, was clocked in 1 minute, 29 4-5 seconds, against 1 minute, 16 seconds for Camille Jenatzy's four-cylinder, 150-horsepower Mercedes of 6 4-5 by 6 1-5 inches bore and stroke. Although beaten by this leviathan, the Lion-Peugeot, while rated at only 6 horsepower, according to its bore, defeated the Benz, Prince Henry type, of 4 1-2 by 6 4-5 bore and stroke, driven by Heinz, a six-cylinder racing Rossel, a 4-inch bore Metallurgique, and was able to give 22 seconds to the Motobloc and Porthos, Grand Prix winners of 1908.

In the 300 metres hill climb, standing start, Camille Jenatzy made a record in 14 1-5 seconds, using the same Mercedes as for the mile climb. On the shorter distance the single-cylinders did not do so well, Giuppone, driving one of the Lion-Peugeots, making exactly the same time as the Grand Prix Motobloc racer, namely 19 4-5 seconds. This was better time than that of any of the big touring cars, with the exception of a Pipe of 6 1-5 bore by 7 inches stroke, driven by young Ferriol Jenatzy, who is the first example of a second generation of professional automobile racing men.

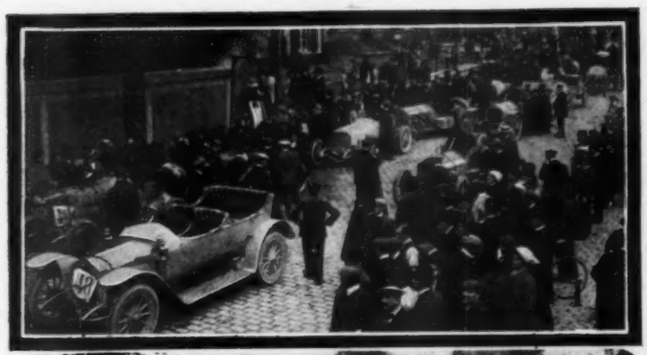
The event was a two-days' meet, opening with 7-kilometer straightaway tests over a switchback road with three sharp curves. The older Jenatzy's Mercedes was first in 2 minutes 55 1-5 seconds, equal to a speed of 89 1-2 miles an hour. Gaste on a six-cylinder Rossel, came second in 3 minutes 30 2-5 seconds, In the single-cylinder section Boillot came first in 4 minutes, 9 2-5 seconds, with his team-mates Giuppone and Goux, on similar cars, very close second and third. In the touring car section the fastest time was made by Joerns, on the Prince Henry type Opel, time 3 minutes, 29 1-5 seconds. Ferriol Jenatzy, in his Pipe, was second in 3 minutes, 34 1-5 seconds, with all the others in very poor position.

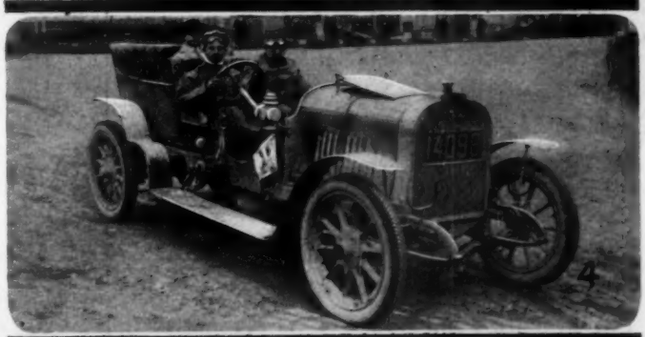
On the second day the road had become so sodden with heavy rain that Jenatzy did not dare start in his powerful Mercedes. Gaste on a six-cylinder Rossel, made the fastest time for the 1 4-5 miles straightaway, standing start. His time was 1 minute, 41 4-5 seconds. He was followed home by Heinz, on the Prince Henry Benz, in 1 minute, 42 3-5 seconds. All the others in this racing class were over two minutes covering the distance.

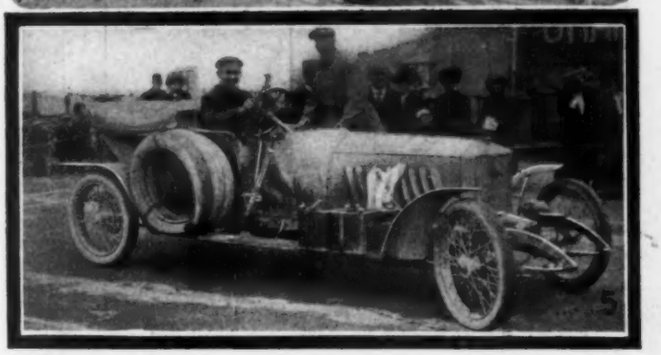
Boillot went over the course on his Lion-Peugeot in 1 minute, 53 1-5 seconds, followed by Giuppone on a sister car in 1 minute, 55 4-5 seconds. Among the touring cars best times were made by Ferriol Jenatzy's Pipe (6 1-5 by 7 inches), in 1 minute, 22 3-5 seconds, and Joerns' Opel (4 1-2 by 6 4-5 inches), in 1 minute, 43 1-5 seconds.

The mile hill climb placed Jenatzy's Mercedes first in 1 minute, 16 seconds; Heinz's Benz second in 1 minute, 31 seconds; Gaste's Rossel third in 1 minute, 38 4-5 seconds. In the one-cylinder class Boillot, on Lion-Peugeot, won in 1 minute, 29 4-5 seconds; Giuppone, on Lion-Peugeot, 1 minute, 37 3-5 seconds; Goux, Lion-Peugeot, 1 minute, 52 2-5 seconds. Ferriol Jenatzy's Pipe made the fastest time in the touring class, being clocked home in 1 minute, 22 3-5 seconds, with Joerns' Opel second in 1 minute, 30 1-5 seconds.

The 300 metres hill climb, standing start, placed Camille Jenatzy first with 14 1-5 seconds, beating the previous record held by Rigal on a Bayard-Clément. Best time for this hill climb in the single-cylinder class was 19 4-5 seconds. Ferriol Jenatzy's Pipe led in the touring class—time, 17 1-5 seconds.

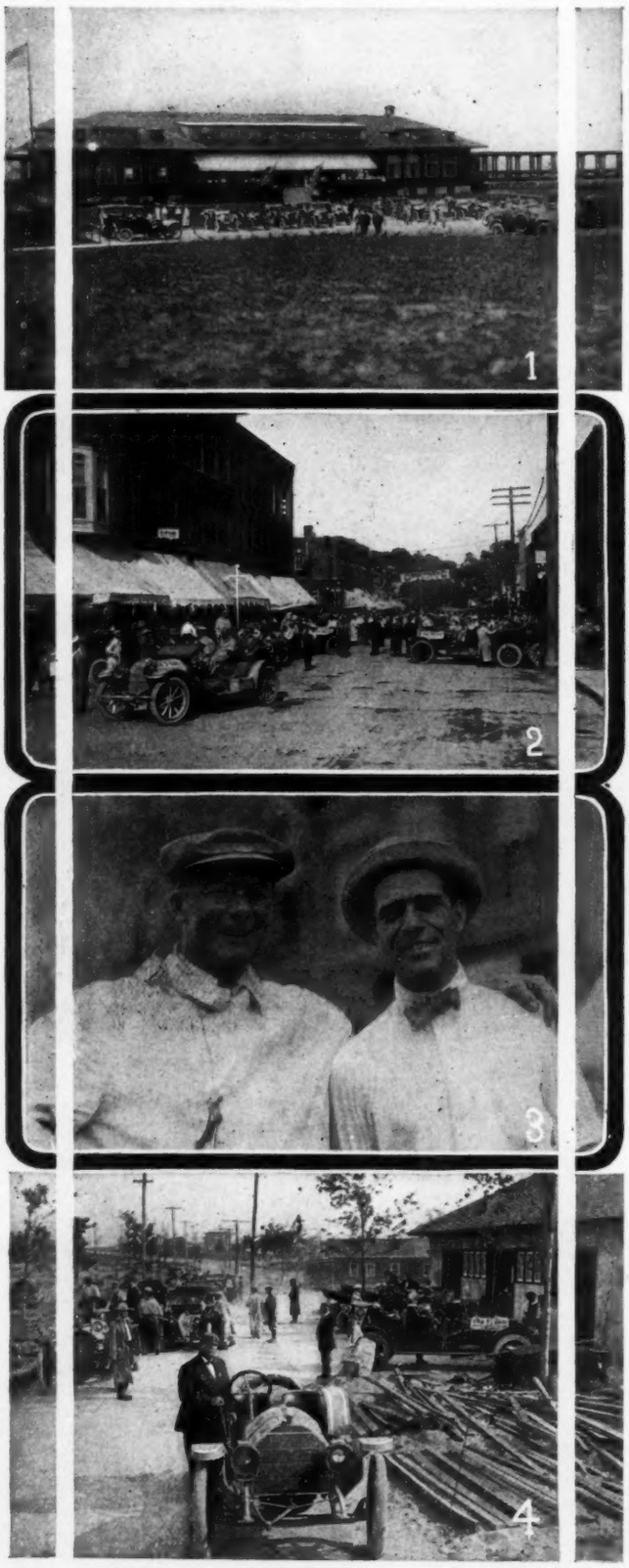






1—Meeting at Boulogne. General view of start
2—Giuppone's Peugeot starting in the Gouy Prix race
3—C. Jenatzy in his Mercedes, which made best time
4—Ferriol Jenatzy's Pipe, which won the City of Boulogne prize
5—Opel, which won Carman, Chimay and Papillon Imperial cups

Chicago Athletics Win Back Club Cup



1—The contesting cars parked at Edgewater Club
2—Buchanan, Mich., gave the run a great reception
3—N. H. Van Sicklen, Sr., and Chas. T. Knisely
4—Stopping at garage at Edgewater Club, St. Joe

CHICAGO, July 30—The third annual interclub reliability team-match between the Chicago Automobile Club and the Chicago Athletic Association, an amateur affair, was run July 28-29, going to St. Joe, Mich., and return, a distance of 132 miles each way. As a result, the Chicago Athletic Association regained the trophy which it won the first year and which was taken the second time by the Chicago Automobile Club. The C. A. A. team won because it had the fewest points against the thirteen cars which ran—55.3—while the C. A. C. had 77 points for eleven cars. Because of the uneven sides the former was penalized only 11-13 point per point.

The twenty-four cars got away promptly Thursday morning from the Chicago Automobile Club and the first day's itinerary included checking stations at Valparaiso, 60.4 miles; La Porte, 84.2; Buchanan, Mich., 110, and St. Joe, 131.8.

The second day's running brought penalizations only to six cars—two on the C. A. A. side and four on the C. C. C. Chamberlain and Thorne were the Cherry Circle unfortunates, while on the losing side N. H. Van Sicklen drew 5 points for work on the jackshaft; Charles Bosch had a motor stop; J. T. Brown an engine stop and L. E. Myers drew 20 points because of a clogged gasoline line. Chamberlain of the C. A. A. was the only one penalized the second day for being late—44 points.

Twenty-four cars lined up for the start from Chicago

While most of the towns along the route displayed interest in the match, it remained for Buchanan to outdo itself. Mayor Hamlin had banners across the street and halted the procession long enough to hand out refreshments. Summaries:

CHICAGO ATHLETIC ASSOCIATION

No.	Driver	Car	1st Pen. Day	2d Pen. Day	3d Pen Day
1	C. T. Knisely	Palmer-Singer	5.06	0	5.06
3	S. W. Hamm	Locomobile	0	0	0
5	A. H. Coon	Stoddard-Dayton	0	0	0
7	W. F. Grower	Diamond T	0	0	0
9	C. C. Ireland	Stoddard-Dayton	0	0	0
11	W. H. Chamberlain	Rambler	0	44	44
13	R. B. Wilson	Franklin	3.1	0	3.1
15	H. H. Latham	Rambler	1.65	0	1.65
17	C. A. Briggs	Chalmers	0	0	0
23	W. C. Thorne	Palmer-Singer	0	1.5	1.5
25	F. W. Wentworth	Rambler	0	0	0
27	H. G. Jackson	Locomobile	0	0	0
31	L. T. Jacques	Peerless	0	0	0
	Total				55.3

CHICAGO AUTOMOBILE CLUB

2	N. H. Van Sicklen	Apperson	5	5	10
4	Charles Bosch	Stearns	0	1	1
6	W. C. Atwell	Stoddard-Dayton	7	0	7
8	Carroll Shaffer	Stevens-Duryea	0	0	0
10	E. T. Franklin	Moon	17	0	17
12	N. H. Van Sicklen, Jr.	Apperson	0	0	0
16	R. O. Evans	Apperson	2	0	2
18	P. J. McKenna	Pierce-Arrow	0	0	0
20	F. X. Mudd	Ford	0	0	0
22	J. T. Brown	Velie	1	1	1
24	L. E. Meyers	Apperson	18	20	38
	Total				77

Parade and Races at Opening of Beach Boulevard

JACKSONVILLE, FLA., July 30—The new Atlantic Boulevard, connecting Jacksonville with San Pablo Beach, was formally opened with an automobile pageant and parade on Friday. The road is 20 miles long and is considered one of the finest bits of road construction in the South. The surface is of cement, brick and gravel, and several concrete bridges have been installed. Work on this road commenced 20 years ago, but was abandoned and taken up several times before it was finally completed. Miss Marie Hyde christened the new road with a bottle of wine just before the start of the parade.

With an attendance between 7,000 and 10,000 the first racing of the season at the beach proved to be a success. The opening of the new road was the occasion of the meet. Before the races a parade was given around the city of Jacksonville and then the cars went out the new road, which had never been used before. More than 500 machines took part in the parade.

Three events were run off. The first, for cars in Class D, at two miles, was won easily by W. A. B. Worley in a Hupmobile in 2 minutes and 55 seconds.

The feature event of the afternoon was the second, in which there were five starters. Dr. Stinson's Oldsmobile won in 8

The third event, between an American, belonging to F. W. King, and the National of J. J. Logan, went to the latter, which

Miss Marie Hyde christening the new road

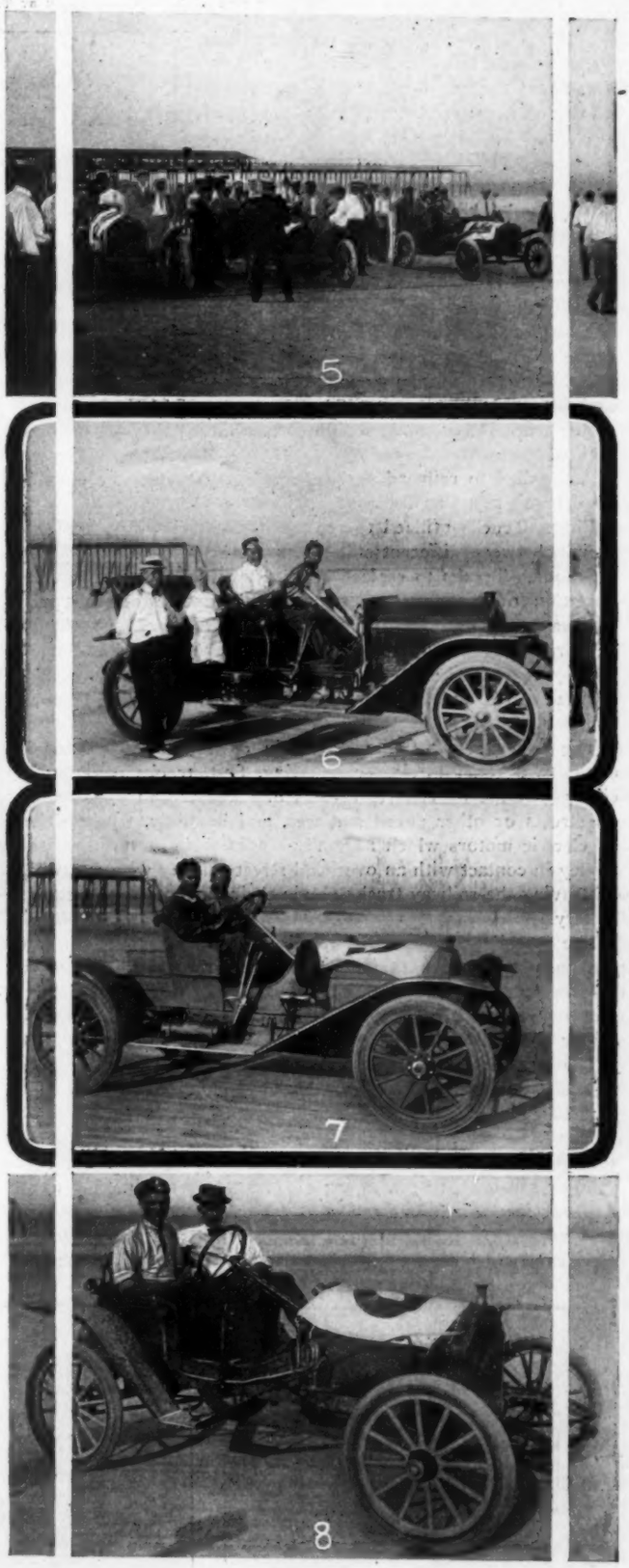
covered the distance in 14 minutes and 27 3-5 seconds. Following are the summaries of the events:

Class D—			
Car	Driver	H. P.	Time
Hupmobile	W. A. B. Worley	20	2:55
Ford	Dexter Kelley	20	.....
Hupmobile	J. E. Johnson	20	.....
Empire	F. C. Miller	..	.....
For Class A—			
Car	Driver	H. P.	Time
Oldsmobile	Dr. Stinson	40	8:36 1-5
Premier	C. B. McNair	40	.....
Overland	J. J. Ahern	40	.....
Marion	H. C. Hare	40	.....
Pratt-Elkhart	G. T. Parson	35	.....
Class C—			
Car	Driver	H. P.	Time
National	J. Gilbert	40	14:27 3-5
American	F. W. King	50	.....

Georgia's New Automobile Association

JACKSON, GA., July 31.—An addition to the growing list of Southern automobile associations was made here when the Middle Georgia Automobile Association was launched. The objects of this organization are to encourage the building of good roads and the promoting of race meets.

The officers elected were: W. H. Mallet, Jackson, Ga., president; Paul Turner, of McDonough, first vice-president; R. A. Franklin, Jackson, treasurer; J. D. Jones, Jackson, secretary.



5—Start of the first event, for little cars
6—The National which won the Class C event
7—The Cadillac "30" which made fast time
8—The Hupmobile which performed well in first race

Motor Trucks for Railroad Service

Extracts from a Paper Read at the S. A. E. Convention by T. V. BUCKWALTER, Member Society of Automobile Engineers.

The substitution of motor-propelled for horse- and hand-drawn trucks in railroad freight and baggage service is progressing rapidly, the Pennsylvania Railroad being especially interested along these lines. A field of usefulness for these trucks is also opening in railroad shop work.

THE development of the motor truck is the result of the demand for more rapid and cheaper transportation in industrial plants, in large terminal stations, and on our public thoroughfares. Manual labor and the horse have long been the sources of power for the operation of trucks, and the development of the steam locomotive in the last century has strengthened, rather than weakened their position, by greatly reducing the cost of transportation and increasing thereby the volume of freight. Steam, however, is performing the long end of the haul between distant points, leaving to the horse the shorter hauls of collecting and distributing goods at freight stations, and to manual labor the trucking between train and wagon platform. It is in these latter two fields that the motor truck is becoming, within certain limits, a successful competitor.

As applied to railroad service, motor trucks may be classified into three groups as follows:

First. Trucks utilized to replace box cars in the transfer of freight between different stations in the same city.

Second. Trucks to replace horse-drawn vehicles in the transportation of both passengers and merchandise on the public highways.

Third. Trucks to replace manual labor in the handling of baggage and mail in large stations, machinery and supplies in railroad shops, and in the transfer of freight in large freight and transfer stations.

The first group is limited to trucks of large capacity, and includes two general types, comprising, first, trucks propelled by either gasoline or electric motors and adapted to operate only on streets or other paved surfaces, and secondly, trucks driven by electric motors which normally obtain their power through a trolley in contact with an overhead street railway wire, but which on leaving the railway tracks obtain their current from a storage battery.

The second group, namely, trucks directly in competition with the horse, comprises taximeter cabs for the transportation of passengers at our large stations, as well as the general class of motor trucks used for freight delivery and for general service in our shops and offices.

The most important field for the operation of motor trucks is in the delivery and collection of freight, generally spoken of as "store door delivery." It includes the collection of freight from the sidewalk of the shipper and delivery at the door of the consignee, all handling being done by the transportation company or a subsidiary company acting as its agent.

Motor trucks in which power is brought into competition with man are represented by three general types, according to the service in which they are used. These are electrically operated baggage and mail trucks, shop trucks and warehouse trucks. All of these are for inside service, and therefore electricity is the only form of motive power available, on account of fire risks and odor.

The handling of mail and baggage in large terminal stations has increased to such an extent as to seriously hamper the expeditious movement of passengers and baggage, and requires the service of a large and constantly increasing force of men.

Recognizing the desirability of motor-propelled mail and baggage trucks that would decrease the time required to transfer baggage and mail from the receiving room to the train, and vice versa, the Pennsylvania Railroad Company about six years ago purchased two electric trucks and placed them in service at the Jersey City station. These trucks had a capacity of 4000 pounds, the weight of each truck being approximately 8000 pounds, but they proved too long and too heavy to operate to advantage.

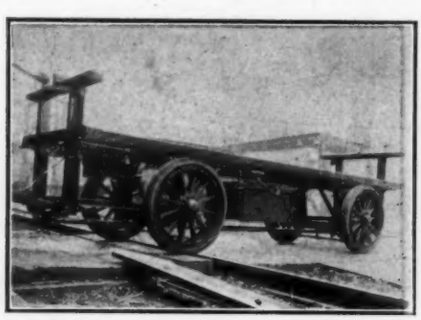
The next experiments were along the line of applying power to the standard hand trucks. About four years ago the company constructed two electrically operated mail trucks and one baggage truck and purchased a similar truck from another company.

The baggage truck consists of a standard baggage truck, with the exception that the front wheels are mounted on a knuckled axle, as used on automobiles, in place of the ordinary fifth wheel.

A twenty-volt motor is applied to each wheel, through double-reduction spur gearing; the motors are connected in parallel and act essentially as one motor; but the use of two motors obviates the necessity for a differential gear. Each motor is provided with an electric brake mounted on the armature shaft, consisting of a bronze disc, which rotates between a magnet and its housing, this disc being clamped between these surfaces by compression springs. In starting, the brake is released by passing current through the magnet.

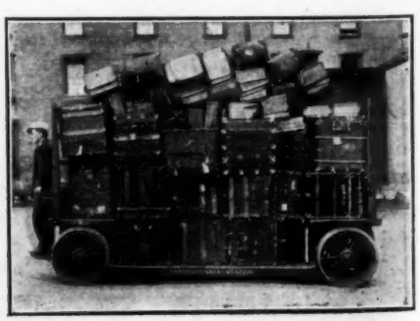
The controlling apparatus consists of a master controller mounted in the steering handle of the truck. This master controller has three positions and is operated with one finger by being pulled forward against the action of a spring which tends to return it to the inoperative position. The first notch releases the brake; the second notch connects the battery with the motor through resistance; the third notch cuts out this resistance, allowing the truck to run at full speed. A reversing switch, mounted in the contactor box, is operated by a rod extending to the front of the truck. The speed of this truck is three miles per hour empty, and two and one-half miles loaded; its weight is approximately 2000 pounds.

The mail truck consists of a standard mail truck with knuckled front axle. This truck, however, was provided with a single El-

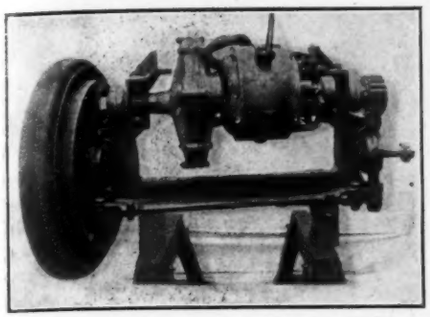


Chassis of Buckwalter straight frame truck

Buckwalter straight-frame truck with load



Buckwalter drop-frame truck with load of baggage



Driving unit of Buckwalter truck showing "universal pinions," and steering-knuckle

well-Parker motor, driving through spur gear to the countershaft and by double side chains to the rear wheels. It is provided with a disc brake similar to that on the baggage truck. An indirect controller is used, consisting of three contactors operated by two drums in the master controller, one being used for forward movement and the other for reverse. The truck was also provided with a current-limit switch, to prevent the operator from starting the truck too quickly. The speed of this truck was about 4½ miles per hour empty, and about 3½ miles loaded, and its weight 2300 pounds. Neither the mail nor baggage trucks had provision for carrying the driver, it being necessary for him to walk in front as with the ordinary hand truck.

The principal characteristics of the new double-end electric mail trucks now in use at the Washington Terminal are as follows:

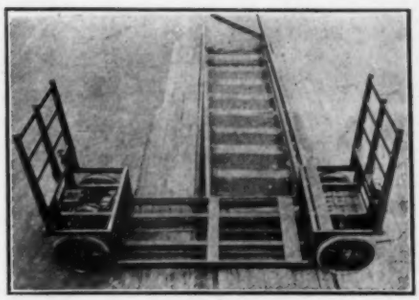
1. Arrangement of controlling apparatus to be operated with equal facility from either end, avoiding the necessity of turning on narrow platforms and runways.
2. Provision for driver to ride for the purpose of running at a higher speed; as a means of conserving his energy for transfer of baggage at his destination, and to give him more positive control of the truck.
3. Operation of brake with least effort and in a manner most natural to inexperienced men.
4. Reverse motion in natural manner.
5. Ease of steering, resulting in more positive control.
6. Flexible frame, on 4-point support to provide greatest stability, with each wheel carrying its quota of load.
7. Increase of tread so that wheels are just within protection of side sills and reduction of hub projection to rim of wheels, to reduce possibility of collision with railroad equipment, columns and other trucks.
8. Flexible suspension of batteries.
9. Direct operation of controller.
10. No projection of controlling apparatus beyond end sills of truck when not in use.

At the Jersey City Terminal there are now in use double-end electric baggage trucks with a length of twelve feet over the end standards. The height of the floor has been reduced to thirty inches, and the height over the end standards and the width were increased to seven feet and forty-four inches respectively. The carrying capacity has been approximately doubled, the trucks carrying eighteen to twenty-four trunks. The capacity expressed in pounds is 4000, while the weight of the truck is 2390.

On account of the limited space beneath the body it was found inconvenient to use the folding platform for the driver. A platform about eighteen inches square is provided at each end of the truck, and hinged to the end standards. These are connected by means of cable, so that when one platform is lowered to the operative position, the other platform is drawn up against a stop, thereby determining the position of the platform in use. The four-wheel steering arrangement is retained, the operating links, however, being considerably simplified. A single steering lever is provided which may be inserted in taper sockets mounted at each end of the truck.

Three speeds are provided in each direction, the second and third being made running speeds. The second speed is from four to five miles per hour, and the third from five to seven miles per hour, depending upon the load and grade.

Practically no change has been made in the method of driving the new trucks, with the exception that the countershaft and motor gearing are enclosed within an aluminum housing and run in oil; furthermore, on account of the limited space available, the universal pinions engage with internal gears which are an integral part of the rim of the driving wheels. The strength of the gear teeth is greatly increased by utilizing the twenty-degree stub tooth.



Plan view of Buckwalter drop-frame truck

The brakes are of the internal-expanding type, but are mounted on the trailing wheels instead of the driving wheels as on the Washington trucks. The introduction of a divided expanding pin in alignment with the steering knuckle has resulted in a uniform application of the brake regardless of the direction the truck is running or the end from which the brake is applied. The same size motor is used, but the capacity of the battery has been increased to 196 ampere-hours. The battery is composed of twelve cells, mounted in one tray, which is spring-supported and readily removed. A battery transfer system is in use at Jersey City, by means of which it is possible to change batteries and keep the trucks in operation twenty-four hours a day.

The wheels are twenty-seven inches in diameter, of the artillery type, with malleable hubs, wood spokes and steel rims, fitted with three and one-half-inch solid rubber tires. The rim is made in two sections and clamps the spoke in such a manner as to avoid reducing the size of the spoke, where it is ordinarily tenoned in a wood felloe. This arrangement permits of using any of the standard methods of tire fastening and is a stronger and lighter construction than the standard artillery wheel.

The steering-knuckle is of a special form which reduces the projection of the hub beyond the side sills of the truck to only three-fourths of an inch. The side sills are also of a special section of pressed steel that provides a round metal roll on the top of the floor line, to take the wear of loading and unloading baggage. This construction also permits the removal of one floor board without disturbing the others. The end construction is also of pressed steel.

The trailing axle is interchangeable with the axle on the driving unit, but brake-hangers are provided in the bearings, which on the driving axle carry the countershaft housing. A wheel with the brake is shown in position, while on the other end of the axle the wheel is omitted to show more clearly the relative position of the brake band and steering-knuckle.

The use of motor trucks in railroad shops may be considered as a logical development from electrically-operated baggage trucks. Manufactured articles and supplies must be hauled from storehouses to engine houses; rough castings are carried from casting-yards and forgings from smith-shops to various machine shops, where, in the case of complicated pieces, they may be still further transferred from machine to machine, and finally be hauled either to the erecting shop or a storehouse. In addition to this, there is a considerable transfer of supplies and manufactured articles between the various storehouses. It is the practice to do most of this hauling with four-wheeled hand-operated trucks, but with the development of the electric baggage truck an extensive field for motor trucks to handle this industrial service is opened. Instead of four men to a truck with a load of possibly one ton, one man can easily operate an electric truck with a load up to 4000 or 5000 pounds, at about double the average speed of the hand truck. Space, however, is more restricted in shops than on baggage platforms, passageways more narrow, which renders a somewhat smaller truck desirable.

Establishment of a Court of Patent Appeals

EXTRACTS FROM A PAPER READ AT THE S. A. E. CONVENTION BY E. J. STODDARD.

THE engineer and scientist is being summoned, with the inevitable and irresistible force of the "mill that grinds so fine," to bear an important part in regulating social relations. Fully half of our educated men are educated scientifically. A quality of masculine strength and steadiness is recognized in them that promises a building up with adequate and substantial foundation that shall secure efficiency and permanence.

The organized bodies of engineers are recognizing the call to public duties. The American Society of Mechanical Engineers, for instance, has a number of committees on public relations.

The applied sciences are fairly well intrenched as to their general rights, but the "remedies" are lacking, imperfect, inapt, or inefficient in their application. Attention should be especially given to a limited field capable of fairly definite formulation, where some sort of a legal remedy is provided by statutory law to perfect a long recognized "general right" of the engineer.

Intellectually, the engineer may be of service in two ways: by bringing into use existing knowledge, or by bringing into existence a new idea. The last is called invention, to which all good acquired by the effort of man is to be ascribed; its accomplishments are the just measure of civilization.

Public sentiment has forced legislation, but its expression in legislation and by the courts has been somewhat imperfect, as far at least as the engineer is concerned. The formulators of the laws have not been effectively advised by those who are most concerned.

In the *North American Review* for January, 1905, Mark Twain, writing upon the "Copyright Laws," touches also upon the patent laws, and brings out distinctly the contrast between the intention of the laws and their results. His article is in the form of questions and answers. He says:

"Q. Certainly there is something most grotesque about this. Is this principle followed elsewhere in our laws?

"A. Yes, in the case of inventors. But in that case it is worth the Government's while. There are a hundred thousand new inventions a year, and a thousand of them are worth seizing at the end of the seventeen-year limit. But the Government can't seize the real and great immensely valuable ones—like the telegraph, the telephone, the air-brake, the Pullman car and some others—the Shakespeares of the inventor-tribe, so to speak; for the prodigious capital required to carry them on is their protection from competition; their proprietors are not disturbed when the patents perish. Tell me who are of the first importance in the modern nation.

"Q. Shall we say the builders of its civilization and promoters of its glory?

"A. Yes, who are they?

"Q. Its inventors; the creators of its literature; and the country's defenders on land and sea.

"A. I think so. Well, when a soldier retires from the wars the Government spends $150,000,000 a year upon him and his, and the pension is continued to his widow and orphans. But when it retires a distinguished author's book, at the end of forty-two years, it takes the book's subsequent profits away from the widow and orphans and gives them—to whom—"

He concludes that these subsequent profits go, not to the public for whom they were intended, but to the publishers who give no adequate return.

It is the will of a generous people that the road to honor and wealth should be free and open to the intellectual creator. The expression of this will is confused and indistinct. What can be done about it?

A distinct step in that direction, which specially concerns the engineer, may be taken in the immediate future, and bids fair to be embodied in a law even by the present Congress.

It is proposed to create a court of practically final resort to hear appeals in patent cases, to take the place of the nine or ten Courts of Appeals now existing, with their conflicting decisions and numerous disadvantages.

The necessity of such a court is obvious and pressing. The bill creating it has been favorably reported on by the House Committee on Patents and by the Senate Committee on Patents. It has been referred to the Judiciary Committee of the House, and is now before that committee.

The bill provides for the appointment of a Chief Justice by the President of the United States, in the usual way, and that the Chief Justice of the Supreme Court of the United States shall designate four Federal Judges to sit as Associate Justices, for a term of six years.

There are certain technical difficulties that the establishment of this court will surely cure. These are ably set forth in a printed argument prepared by the Committee of the Patent Branch of the American Bar Association. This argument is plain, unanswerable, and it will be sufficient to carry the bill through. But no effort ought to be omitted.

There are, however, outside of strictly legal matters, a number of considerations that should appeal to a society of engineers.

There are many complaints of the present administration of our patent laws. Such complaints are in a large measure just, and the faults remediable. But in remedying existing faults we do not want to introduce greater faults or destroy a right that should be the most sacred and firmly based of all rights to property.

In establishing this court the service of the whole people must be kept in view, not that of any class or profession. It should not be a court in the interest of manufacturers, of engineers, or of lawyers, but a court that shall administer justice intelligently and carry out the will of the people as a whole.

In patent cases the questions of fact are questions of mechanics, engineering and science, and they are so interwoven with questions of law that the dividing line vanishes. The value and meaning of a decision as a precedent depends, often, upon the facts.

The American Bar Association Committee on the Court of Patent Appeals says in part in its argument, referring to the confusion due to the conflicting decisions of our nine or ten Courts of Appeal:

"The truth is that the worst effect of the existing situation is that it undermines confidence. It demoralizes the bar. A lawyer does not know how to advise his clients. It tempts both attorney and client to take chances. The law-abiding citizens who want to obey the law, who want to respect valid patents, but do not want to be terrorized into acquiescence in invalid patents, do not know what to do and cannot find out. There is but one remedy, and it is in a single court of last resort in patent causes."

Professor John Perry says that in England the inaptness of their judges in scientific matters is threatening confusion and disaster in this line. If this court is established, America will be taking the lead in providing for the creation of a just and rational system of jurisprudence relating to intellectual property. We believe this is as it should be and in the line of precedents.

Engineers generally should use their best efforts to have the bill in its present form enacted into a law, and watch with friendly interest its working when established, recognizing special ability in any of its judges, when it shall be shown, and being ready to advise if it shall be necessary to take any measure to increase its efficiency.

They say to properly state a problem is to half solve it. When we shall have established this court we will have something definite upon which to concentrate our influence, and to hold responsible. The problem will at least have been stated.

Rejuvenating the Old Automobile

By G. J. MERCER

This effort, following along lines involving the rejuvenation of other makes of cars, has for its subject the Haynes "Thirty" model, with a view to changing it over to a Cruiser type, utilizing the old body to the extent of its adaptability.

AS in previous undertakings of this character, the new body is shown in Fig. 21, and the details for the guidance of the repairman are given in Figs. 22, 23 and 24. Glancing at Fig. 23, it will be observed that the speed-changing lever falls to the inside of the body, and the emergency brake lever is given a kink at a point just above the quadrant to bring it outside of the body line. The relations of the levers are also indicated by dotted lines in Fig. 22, which figure has the further facility of indicating the dimensions and scheme of framing for the new front door, modate the same. In the framing process, the workman will understand that the offset of the pillar A, Fig. 22, is only 1 1-2 inches out from the underbody at the bottom, and the finish corresponds to that of the rear doors. The amount of work involved in the conversion of the old body to conform to the new requirement is relatively slight, and in the hands of a capable workman the cost should not be high. It will of course be necessary to refinish the whole body, and in this undertaking it will be worth while to do the work so well that it will not be possible for an observer

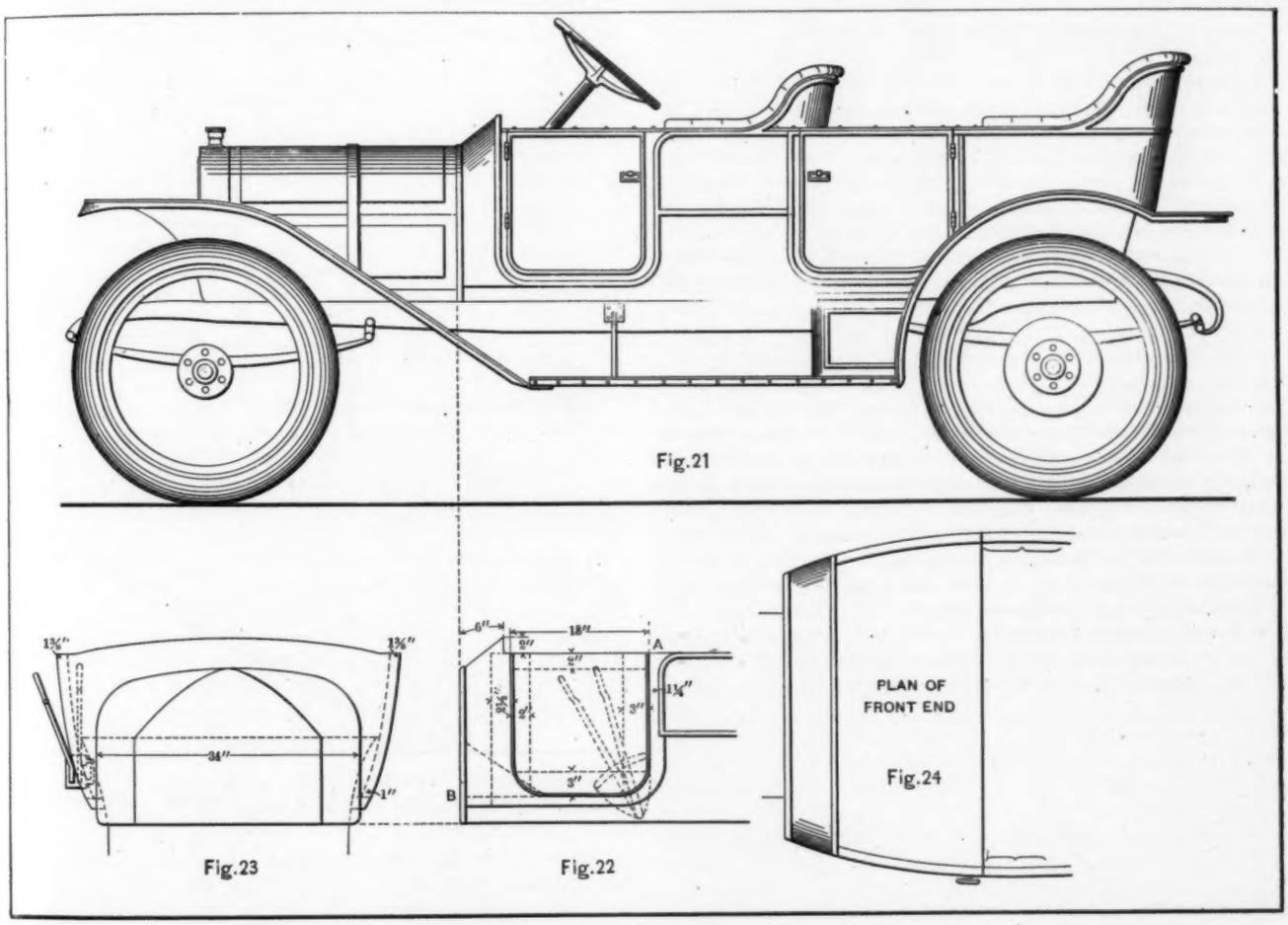


Fig. 21—Haynes "Thirty" model, with new fore-door type body replacing old touring style. Fig. 22—Detail of new fore-door. Fig. 23—Front elevation. Fig. 24—Plan of front end

while the plan, Fig. 24, helps in the proper understanding of the case. The pillar A, Fig. 22, is bent to form the outline of the door, the moulding around the door covers the screws that are used for fastening, and No. 16-gauge aluminum is specified for the panel. The hooded dash is flared from the contour of the hood and brought out sufficiently to accommodate the door which swings to the front and should be fitted with hinges and a handle of the same style as used on the tonneau doors. The right side of the frame is similar to the left, minus the cut for the door, remembering, however, that there is an opening to be provided for the change lever. It is fortunate that the change lever does not have to be altered in any way to bring it within the body in the manner as shown. The quadrant, however, comes rather high above the chassis, and the body must be cut away to accommodate to pick out the new from the old work. The best way, perhaps, is to start from the ground and work up, making the finish uniform over all of the surfaces, and the slight extra cost involved in the more pretentious process will be compensated for by the extra time of service under conditions of a satisfactory appearance of the body.

A Good Finish for Refurbishing the Old Car

After selecting the desired color mix it with raw linseed oil and turpentine in the proportion of one part oil to eight parts turpentine, using a good camel's hair brush to apply it to the surface. After thoroughly dry, lay on a generous coat of heavy body-finishing varnish.

Letters Interesting, Answered and Discussed

Effect of Time and Temperature on Hardening

Editor THE AUTOMOBILE:

[2,337]—I run a small garage in a country town and have to make repair parts frequently requiring hardening, and desiring to deliver better satisfaction than that which can be afforded under ordinary conditions, I have installed a small gas furnace for hardening purposes, but find myself in a quandary in relation to the time I should take in the hardening process and to the temperature required for the best results. There probably are other small garages with similar problems to cope with and a little information on this subject should be timely. A. C. S.

With the advantages offered by a small gas furnace, it remains to either employ a pyrometer in the determination of temperature or become familiar with the color which corresponds to a given temperature, judging by the eye. The effect of time, considering temperature, as it relates to penetration, is shown in Fig. 1. The curve marked 850 degrees centigrade represents the results obtainable with the lowest temperature of cementation, and the curve marked 1000 degrees centigrade gives the penetration, also the highest temperature which should obtain. It will be understood, however, that some one temperature should be held to throughout the carbonizing operation. Just what temperature to adopt depends upon the composition of the steel. If it is very low in carbon the temperature may be relatively high, but if the carbon content is relatively high, the temperature during carbonization should be more carefully regulated. As the curve shows, a penetration of 0.030 of an inch will be had inside of about 1 hour and 50 minutes, if the temperature is maintained at 1000 degrees centigrade, whereas at 850 degrees centigrade the same penetration would require about 3 hours and 55 minutes. These values are relative. If the steel is the usual low carbon product of the market with a carbon content of about 10 points, the temperature should not exceed 1,000 degrees centigrade and good result will come if the same is limited to 900 degrees centigrade. In no case should the steel have more than 20 points of carbon if it is to be subjected to the casehardening process. This process is described in various ways as "casehardening," "cementing" and "Harveyizing"; it is sometimes described as "carbonizing." By penetration is meant the depth to which the carbonizing process is carried in the steel. If the steel is high in carbon the core will not remain soft, nor will the case be dynamic. The way to obtain a soft core and a dynamic case is to start out with mild steel, limiting the carbon content below 16 points in any event (20 points as an absolute limit) and holding to approximately 10 points if possible. The core of the cemented steel will then have the softness and dynamic ability of 10-point carbon steel, whereas the shell or case will have the hardness due to 100 points of carbon, it being true that in the carbonizing process, while a point of saturation is never reached, the carbon content does increase to even a higher level than 100 points of carbon.

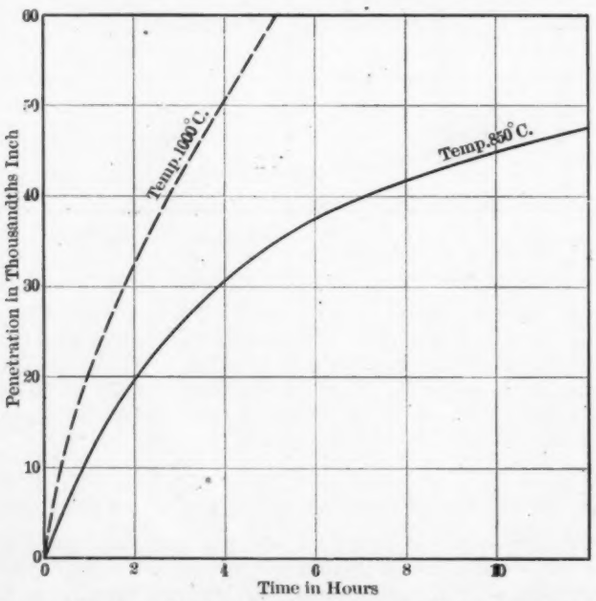


Fig. 1—Diagram showing effect of time, considering temperature, as it relates to penetration, in hardening metal in a gas furnace

Judging temperature by color is not an exact science, especially when the room is more or less flooded with light; if comparison is made in a dark room the results will be more satisfactory. The following tabulation is generally accepted as satisfactory in work of this character:

TEMPERATURE CORRESPONDING TO COLOR DUE TO HEAT

Temperature Deg. F.	Color
977	Incipient red heat
1,292	Dull red heat
1,472	Incipient cherry red
1,650	Cherry red
1,832	Clear cherry red
2,021	Deep orange
2,192	Clear orange
2,372	White heat
2,552	Bright white heat
2,732	Dazzling white heat
2,912	Sweating white heat

To find the equivalent temperature in degrees centigrade for the temperature as measured in degrees Fahrenheit proceed as follows:

$$\text{Degrees centigrade} = \frac{(\text{Degrees Fahrenheit} - 32) \times 5}{9}$$

To find the equivalent temperature in degrees centigrade for the temperature as measured in degrees Fahrenheit—

$$\text{Degrees centigrade} = \frac{(1{,}832 - 32) \times 5}{9} = 1{,}000$$

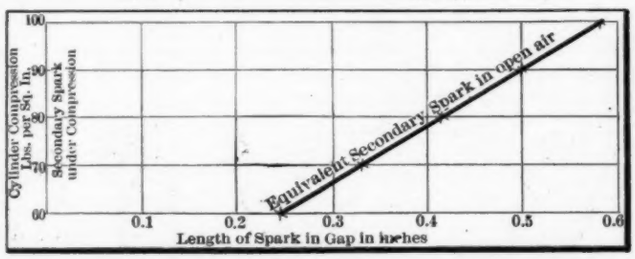


Fig. 2—Diagram showing increase in resistance of spark gap under gas compression in cylinder as compared with same in open air

Thus it will be seen that the highest temperature desirable for cementation is that which corresponds to the clear cherry red, i. e., 1,000 degrees centigrade, the equivalent of which is 1,832 degrees Fahrenheit.

It is believed that the depth of the carbonized shell should be at least 1-32 of an inch, and if the operator does not know the composition of the steel he may find out whether or not it is suitable for this work by proceeding as follows: Heat the steel to a clear cherry red temperature, at which temperature quench it in a bath of salt water, after which if it shows no perceptible increase in hardness as tested by a file it will be suitable for casehardening work.

Resistance of Spark Gap Rises With Compression

Editor THE AUTOMOBILE:

[2,338]—In struggling with ignition trouble on my motor I was much puzzled, due to the fact that when I took the spark plugs out of the cylinders and tried them, I noticed distinctly that there was a spark, but when I put them back in place there

seemed to be no result. After trying everything else I finally substituted a new set of dry cells, when, to my astonishment, the motor worked beautifully. It strikes me that I am confronted by a condition that I do not understand, and I refer it to you with the full assurance to myself that an explanation will be forthcoming.

Red Wing, Minn. SUBSCRIBER.

The amount of information afforded with which to arrive at an accurate conclusion is rather meagre, but the probabilities are that what you needed was a new battery, and the reason you obtained the spark in the open air, but not after the spark plugs were put back into the cylinders, is due to the considerable increase in resistance of the spark gap under gas compression in the cylinder as compared with the resistance of the same in the open air. Fig. 2 as here given shows the relation, in which it will be observed that for a compression of 60 pounds per square inch the equivalent secondary spark in the open air must be about 25-100 of an inch long. This equivalent secondary spark in the open air must be increased in length as the compression increases in the cylinder in order to be sure that there will be a spark in the cylinder under compression; for instance, a spark in the open air 1-2 inch long will barely assure that there will be a spark in the cylinder sufficient for the need under a compression of 90 pounds per square inch.

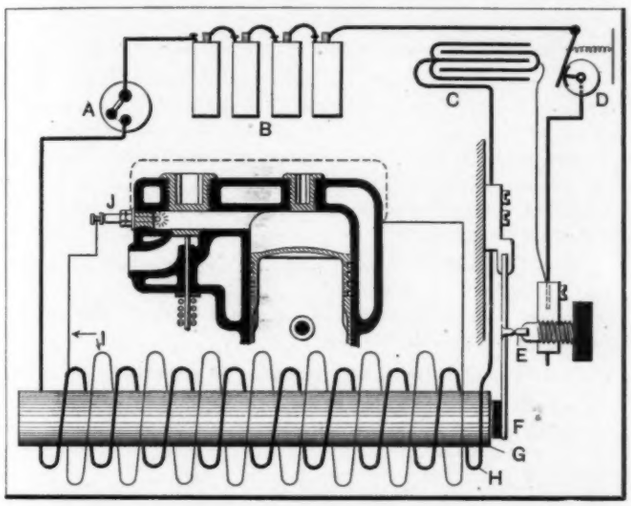


Fig. 3—Diagram of the connections in an ignition system

Cylinder in Question Holds 40 Gallons of Gas

Editor THE AUTOMOBILE:

[2,339]—You stated on page 114 of THE AUTOMOBILE of July 21 that a cylinder measuring 3 1-2 x 13 inches contains about 14 gallons of gas. This looks to me too low a figure.

Hartford, Conn. OXYGEN.

According to James S. Madison, the author of this article, the right figure for the capacity of the tank in question is 40 gallons.

Wants Push Button on the Steering Wheel

Editor THE AUTOMOBILE:

[2,340]—I have a four-cylinder, air-cooled motor to which I wish to add a push button to make the engine start on the spark. I would thank you to tell me how to go about wiring same in the simplest way, so that by pushing a button (separate from the coil) a spark will be obtained at all the plugs at one and the same time.

Jeanerette, La. C. R. P.

Automobile supply dealers are in a position to furnish well-contrived forms of push buttons which may be placed on the steering wheel, and a very good way to make the wiring connections is to take the ground wire from the battery, lead it to the push button on one side and ground the push button on the other side on the steering wheel. It will be understood that what is technically designated as a "ground," is accomplished when the ground wire is led to any part of the metal framing of the chassis or motor, so that the framing itself, being a conductor, becomes a substitute for one of the electrical connections. The battery being grounded on one side will be grounded in just the same way if one of the leads from the push button is connected to the metal steering wheel.

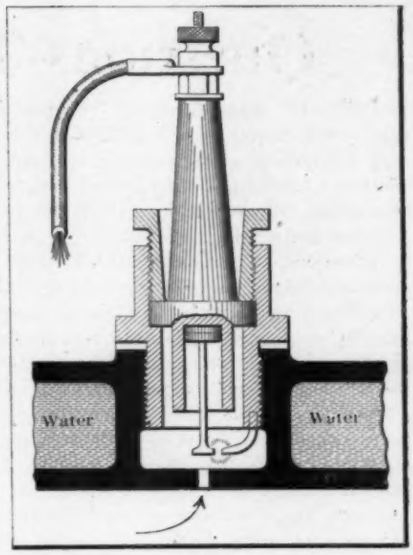


Fig. 4—Spark plug in cylinder head cast with perforated wall at bottom of plug well to protect spark points against fouling.

Connections for Condenser in Ignition System

Editor THE AUTOMOBILE:

[2,342]—I understand in a general way the necessity of employing a condenser as a part of the equipment in an ignition system, but it looks to me as if the condenser as connected up in my car acts to short-circuit the system. One lead from the condenser traces to one pole of the spark gap, and the other lead seems to me to go directly to the other pole. Does this not short-circuit the spark gap of the trembler?

White Plains, N. Y. R. C. N.

According to Fig. 3, a diagram that fits your case, the condenser C is in parallel with the contents E of the trembler. When the switch A is closed, current is supplied by the battery B when the circuit is closed by the timer D, and with the first rush of current across the contact E the core G is magnetized, and due to the change in magnetic flux an electromotive force is set up in the primary wire H, and by induction an electromotive force is impressed on the secondary wire I, thus causing a spark at the spark plug J. When the magnetic flux in the core G is strong enough, it draws the hammer F on the end of the tongue at the trembler, thus opening the circuit at the contacts E, and the condenser C, being in parallel, absorb energy at one point in the wave, delivering it back again to the circuit at another point.

Protection of Spark Plugs the Idea

Editor THE AUTOMOBILE:

[2,341]—I have an air-cooled motor with the spark plugs placed in direct contact with the flame in the combustion chamber, and I use either poor lubricating oil, or the spark plug is in the wrong place. It occurs to me that I might protect the spark plugs to good advantage by not permitting direct flame contact.

Kansas City, Mo. IGNITION.

The first thing to do is to acquire the habit of using good lubricating oil. A poor grade of lubricant is likely to "crack" under conditions of high temperature. Fig. 4 shows a plan that seems to work very well indeed, but it may not be possible for you to rearrange your cylinders in order to enable you to take advantage of the ignition chamber as shown. The diameter of the hole leading from the ignition chamber is about 1-8 inch.

Questions That Arise—General In Scope

Discussing single coil for sparking systems; fuel value of gasoline in B.t.u.; relations between air and metal in cooling systems; relation between diametral and circular pitch of gears; gasoline combustion products.

[187]—In some sparking systems for automobile motors a coil is used for each cylinder, but in a few examples one coil is made to serve for four cylinders. How is the single coil connected up to do the work ordinarily requiring four coils?

When one coil is employed for four cylinders instead of one coil for each cylinder, the high-tension distributor must be employed and the connections are as here shown. The current passes from the battery through a switch to the coil through the trembler with the condenser in parallel across the contacts of the trembler. From the coil a single high-tension lead passes out of the bottom and to the central terminal at the top of the high-tension distributor. The high-tension current is distributed to the four spark plugs on the motor, and connections are completed through ground returns as indicated by dotted lines on the diagram. A better understanding of the functions of the high-tension distributor will be realized by examining the section to the left in the illustration which is of the same. This distributor performs two independent functions, one of which is that of a timer which closes the primary circuit in accordance with the relations fixed in timing the motor, S being the terminal of the primary circuit, R is the insulating bushing, and O is the contact which is held into relation by means of a spring so that when the four high spots N on the enlargement of the shaft rotate with the shaft, they make contact 90 degrees from each other. The shaft is vertical and the bearing T in the housing V centers the same, it being held on the shaft by the locking ring U. The upper end of the shaft M has a flange Y at an insulating piece X fit thereto. Screws K hold the insulating piece to the flange, and the finger I is fastened to the upper end of the insulating piece, being held in place by the screw J. Contact is made between the finger I and the central lead E through the ball H and the terminal piece F into which the terminal of the lead E is soldered. A spring presses the ball H into the socket formed in the finger I. The cap of the timer L is of insulating material, and the terminals A, B, C and D are spaced equidistant around the same, with the central terminal E in proper relation. When it is desired to advance or retard, the spark motion is imparted to the distributor by the lever W, which, by suitable links and motions, connects with a lever on the steering post. The finger I makes the connection from the central electrode E to the electrodes A, B, C and D respectively, which in turn are connected to the respective cylinders of the motor, so that a high-tension current is delivered to the respective cylinders with an equal measure of time between sparks, but since only one coil is employed it must serve as a transformer of the step-up character for four cylinders, whereas in the unit coil work there is a step-up transformer for each cylinder, thus eliminating the necessity of using a high-tension distributor. It will be understood, of course, that the high-tension distributor eliminates the need of three of the four coils.

[188]—What is the fuel value in British thermal units per pound of the contents of gasoline?

According to accepted authority, these values are as follows:

Carbon burned to carbon monoxide	4,100 B.t.u.
Carbon burned to carbon dioxide	14,500 B.t.u.
Hydrogen burned to water	62,032 B.t.u.
Hydro-carbons burned to carbon dioxide	20,000 B.t.u.

From the above it will be seen that a small proportion of hydrogen in the exhaust products of combustion of a motor represents an enormous weight. It will also be noted that unburned gasoline in the exhaust represents a very considerable waste, and that carbon monoxide, if it exists instead of carbon dioxide, lowers the thermal value of the fuel as used from 14,500 to 4,100 British thermal units.

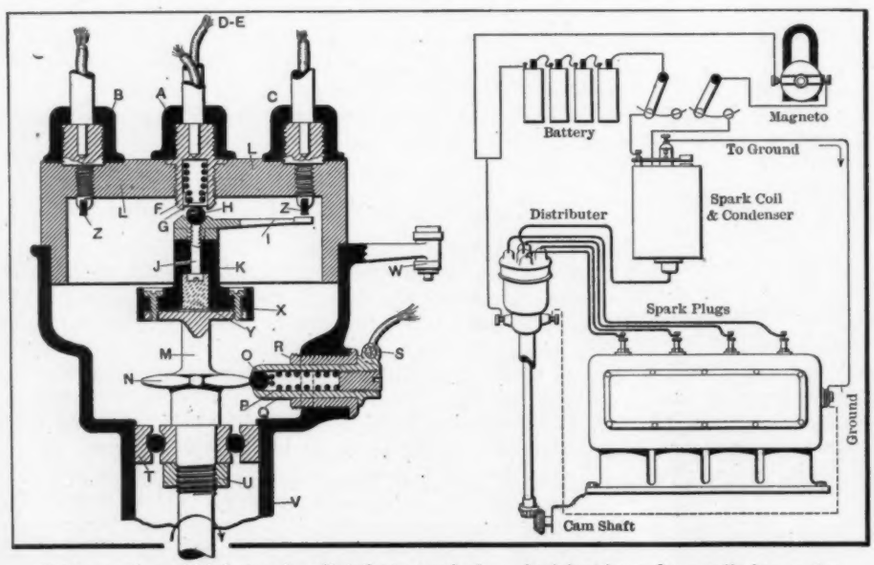
[189]—To what extent is incomplete fuel combustion present due to load changes in a motor?

One test as reported shows changes in a thermal efficiency due to different loading as follows:

EFFECT ON THERMAL EFFICIENCY OF CHANGES IN LOAD

Products	Full Load	Part Load
Carbon monoxide	3.31	6.9
Hydrogen	1.19	2.4
Hydro-carbons	0.30	0.9
Carbon-dioxide	11.90	9.9
Oxygen	0.23	0.3
Nitrogen	83.07	79.6
Total	100	100

It will be seen that the carbon monoxide content is nearly doubled with the part load as compared with the full load. Hydrogen is also nearly doubled, under the same conditions, likewise the hydro-carbon is wasted on a considerably increased basis. The carbon dioxide content is maximum under full load, as it should be, and is reduced considerably with part load, which is a misfortune. The amount of oxygen present is maximum under part load, but in excess under both conditions; this, under the circumstances, is probably a necessity since it seems to be impossible to burn automobile gasoline excepting with an excess of oxygen present. The excess of oxygen was apparently greater under full load conditions than it was with the part load because the nitrogen content is greater with the full load. The ratio of oxygen to nitrogen being constant, it is a fair inference that the amount of air used under the part load conditions was less in proportion than under the full load conditions. From the information thus afforded it is reasonable to expect that the thermal efficiency of a motor will be difficult to maintain when the load is reduced, and that there is some one point in the range of speed and load of a motor at which the thermal efficiency will be maximum.



Cross-section of high-tension distributor and plan of wiring for a four-cylinder motor

In other words, the thermal efficiency is not constant under conditions of changing speed and load.

[190]—What are the relations between the air as it is propelled by a fan by the radiating surfaces of a cooler, and the conducting ability of the metal used in making the cooler?

As compared with any metal, air is a poor conductor of heat; it follows therefore that any metal as used in radiator construction is capable of delivering more heat to the radiating surface than the air can take away unless the difference in temperature between the cooling air and the metallic surface is relatively great. The ability of air to absorb heat is of course limited to its specific heat, and to the difference in temperature between the entering and leaving air. The specific heat of air is very low, and the real problem is to have a very thin sheet of same spread out over the cooling surface. In order to increase the efficiency of the air current as it involves the cooling surface, circulation is set up; this is but another way of disregarding the poor conductivity of air for heat. Instead of the heat having to traverse the air body, the molecules of air are brought successively into contact with the heated surface of the radiator, and as each molecule of air absorbs its quota of heat, it is borne away in the stream. The efficiency of the process depends upon the number of molecules of air that are successively brought into contact with the heating surface.

[191]—What is the relation between diametral and circular pitch of gears?

The circular pitch may be ascertained as follows:

$$\text{Circular Pitch} = \frac{\pi \times \text{Pitch Diameter}}{\text{A number of teeth}}$$

Conversely,

$$\text{Diametral Pitch} = \frac{\text{Number of teeth}}{\text{Pitch diameter}}$$

Numerically,

RELATION OF DIAMETRAL TO CIRCULAR PITCH

Diametral Pitch	Circular Pitch
4	0.785
6	0.524
8	0.393
10	0.314

[192]—What are the products of combustion of automobile gasoline, and in what proportions?

When the gasoline is burned completely, the products of combustion are carbonic acid and water with a small percentage of ash. As a general rule combustion is not complete and carbon monoxide, hydrogen, carbon and hydro-carbon compounds are found in the exhaust. The percentages of the contents of the exhaust vary over wide ranges depending upon the conditions, but according to Bertram Hopkins (paper read before the Institute of Mechanical Engineers at London, England, February 10, 1909) the following exhaust analyses were made, and they should afford an insight into the subject sufficiently for the purpose here. The engine used was a Siddeley.

REPORT OF TEST KNOWN AS TABLE VI

	A1	A2	B
Speed	530	535	930
Gasoline per thousand revolutions (lbs)	0.42	0.375	0.333
Reported Exhaust Analysis:—			
Carbonic acid (CO_2)	13.55	13.4	13.1
Oxygen (O_2)	0.55	1.8	1.3
Carbon monoxide (CO)	0.8	0.0	0.3
Residuum	0.5	0.35	0.7
Air per suction per cylinder	0.041	0.0395	0.0335

It is claimed that under the above conditions the air per suction stroke is about 20 per cent. greater at 530 revolutions than at 930 revolutions per minute. The ratio of air and gasoline vapor to stroke volume is 83 per cent. at the former against 69 per cent. at the latter speed. This condition is due to the better "filling" of the cylinder at the lower speed.

Making Gears Quiet by Grinding

By F. A. WARD

THE automobile engineer in considering the gear problem faces several conditions. The gears used must be sufficiently strong and so designed as to withstand not only a constant operating load, but also sudden shocks that may arise from inexperience or other causes. Also, the public demand a quiet-running gear. There must be skin-hardening of the surface of the gear to give commercial life. After determining the load factor some suitable pitch is chosen, and the form of tooth and the pressure angle are decided upon. The material to be used is also determined. With the above data perfect gears could be secured to meet all conditions except as to wearing life. The hardening of gears sets up inaccuracies which it has been impossible for the engineer to overcome.

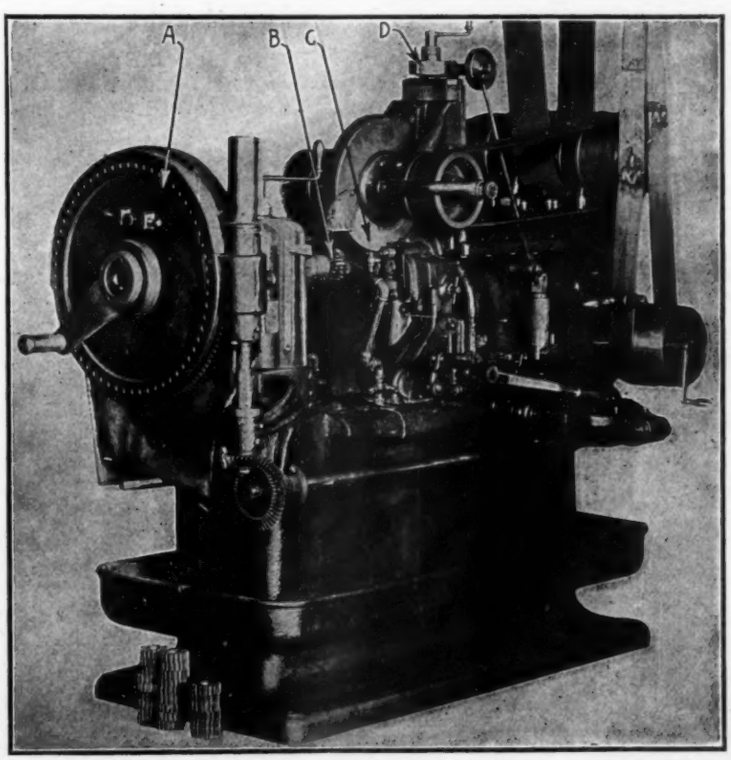


Fig. 1—A, indexing wheel; B, gear to be ground; C, grinding wheel being trimmed; D, automatic device for feeding wheel down as it wears away

Gears may be heat-treated and casehardened and allowed to change in physical form to the fullest extent, but a machine must be devised to restore them to perfect form at a commercial cost. Prior experimenters have generally tried to use a thin abrasive wheel, whose revolving perimeter would trace up and down the curve of the gear tooth. But the wear on such a wheel was marked, and it was found impossible to maintain it continuously to form. The basic idea was to use a unit area of grinding wheel to the unit area of surface to be ground and to maintain this unit area of grinding wheel to the constant form desired by means of some trimming device. A first experimental machine was completed in 1907. From then until the latter part of 1909 the

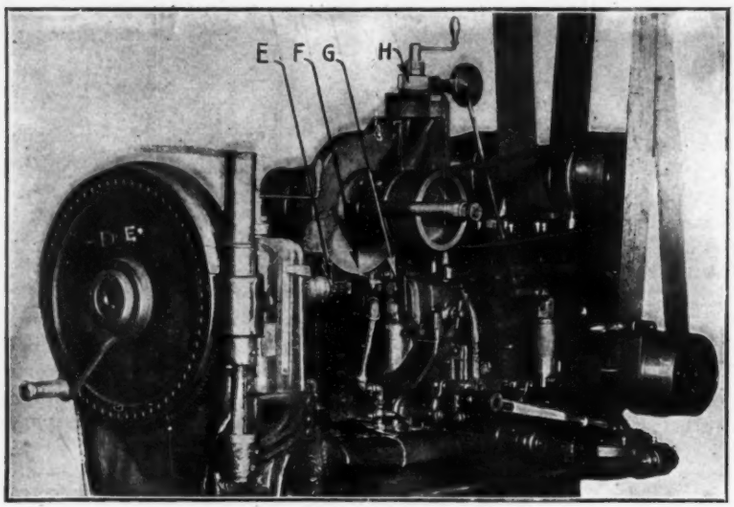


Fig. 2—E, gear to be ground; F, grinding wheel just before entering gear; G, grinding wheel automatic trimming device; H, automatic device for feeding wheel down as it wears away

machine was in process of development. During the early part of this year it was the practice to grind rough-cut hardened gears with such a degree of accuracy that in measuring a group of teeth the variation from theoretically absolute accuracy has been less than .001 inch or less than .0002 inch per tooth. The machine has also obtained such speed as to make it a success.

There are here illustrated the present Type A grinders, which are designed to handle a line of gear work from the smallest up to and including 12 pitch diameter, as heavy as 4 pitch and with a face dimension up to 4 inches. The gear, rough-cut or as the case may be, with stock allowed for finishing in the grinder, is mounted upon an arbor in a manner similar to that employed in gear-cutting. By means of a number of well-known mechanical movements the grinding wheel, revolving at a proper rate of speed, is brought forward and passes with a shaperlike movement between the gear teeth. This grinding wheel is of a grade suitable for grinding the material of which the gear is made, and is kept continuously to the required form by means of an automatic forming device.

In order to grind gears successfully the indexing device is of the utmost importance, as the extreme of accuracy is required. A newly developed indexing device has eliminated the common trouble arising from friction driven indexing devices and is now used upon the machines.

For obtaining the required number of divisions the common method of change-gears is employed.

The forming device is a simple combination of mechanical movements. Any standard form of spur gear teeth and many so-called freak forms are easily developed upon the sides of the grinding wheel and rapidly reproduced upon the gear.

Within this device, not visible in the illustrations, is a master form, which is mathematically calculated and laid out in advance, and by means of the mechanical movements regulates and controls absolutely the curve through which the trimmer diamonds pass.

To change the form upon the periphery of the wheel for grinding different types and forms of teeth, the operator simply replaces the controlling form in use with the one desired and retrims the grinding wheel, operations which require but a few minutes.

The foregoing has treated more particularly with the production of gears for use in automobile construction.

The use of these machines for the production of gears for automobile work has been an afterthought. The making of gears for the industrial field from materials which have hitherto been commercially impracticable on account of many difficulties, has been one of the influences in the development of these machines. There are materials from which there can be cast roughly to form gears, which, after being finished by the grinding process outlined, will show easily from five to seven times the life of the ordinary forged and heat-treated gear. The only method by which it has previously been possible to finish the teeth of such cast gears is by hand through the use of emery.

No comment need to be made as to the long step forward which this gear-grinding machine shows in the art.

A Standard Automobile Nomenclature

A Paper Read at the S. A. E. Convention by F. E. WATTS, Member Society of Automobile Engineers

THE automobile business has grown far too rapidly for its "dictionary" to keep pace with it. Probably all of us who have helped in the production of detail drawings, in the making of parts in the factory, in sending repairs to agents and owners, or in writing about any of these, have noticed the lack of uniform names for parts and operations, and have wished that we had at command words sure to be understood.

Feeling the needs of such specific works in the conduct of his own business, and judging that others have experienced the same difficulties, the president has asked me to bring the matter before this society in the hope that some steps may be taken looking toward the adoption of a set of standard automobile terms.

Of course, we already have a sort of glossary, but it has grown so rapidly that there are often several names for the same part. For instance, the piece which supports the front wheel is varyingly called "steering pivot," "knuckle," "front wheel spindle," etc. The rod fastening these together is known as "drag-link," "steering-link," "reach-rod," "steering cross-connection," "cross-rod," "tie-rod." As to the motor, we have "wrist-pin," "gudgeon-pin" and "piston-pin" for the same part; while the piece which connects this with the crankshaft is sometimes called the "pitman," though more often known as the "connecting-rod." Scores of similar examples will suggest themselves to the engineer.

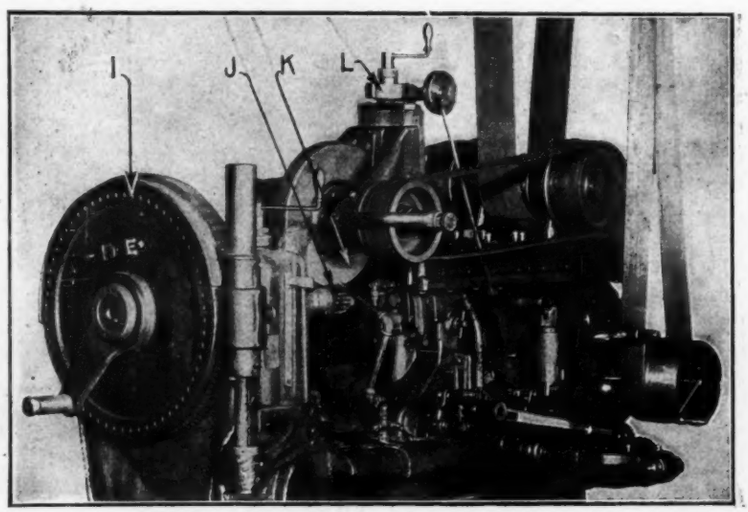


Fig. 3—I, indexing wheel; J, gear to be ground; K, grinding wheel entering gear; L, automatic device for feeding wheel down as it wears away.

We know that words are merely collections of letters, and that most of them have a good many meanings, according to the nature of the sentence they are used in; and, moreover, that there are few words which mean the same thing to a speaker as to his hearers. Nevertheless, it is probably possible to standardize at least the nouns which denote the principal parts of motor cars. We probably would not care to try to standardize the adverbs and adjectives which are applied to the nouns, especially those used in a break-down "forty miles from home."

While the alphabetical order of arrangement of parts is the most natural, there are so many pieces to an automobile that such a list is too long for handy reference, unless it is subdivided. Fortunately, the manner in which cars are assembled naturally provides such divisions, which are used in making up parts lists in all motor car factories.

The following headings are those taken from the price list of repair parts of the Chalmers 30, 1909 model. This parts list was selected because it is unusually complete and also illustrated with sketches of the parts. We will refer to the proposed use of these sketches a little later.

List of Assemblies, or Groups

Accelerator Assembly.
Axle Assembly (Front).
Axle Assembly (Rear).
Propeller-Shaft Assembly.
Body Assembly.
Clutch Assembly.
Dash Miscellany.
Dust-Pan Assembly.
Equipment Miscellany.
Fan Assembly.
Frame Assembly.
Gasoline-Tank Assembly.
Gear-Shift-Guide Assembly.
Hand Lever Assembly.
Hood Miscellany.
Ignition Miscellany.
Motor Assembly (which includes)
Camshaft Assembly.
Carbureter Assembly.
Connecting-rod Assembly.
Crankcase Assembly.
Crankshaft Assembly.
Cylinder Assembly.
Oil Pump Assembly.
Timer Assembly.
Valve Rocker-arm Assembly.
Water-pump Assembly.
Mudguard and Running-board Miscellany.
Muffler Assembly.
Muffler Cut-out Control Assembly.
Pedal-control Assembly.
Radiator Assembly.
Rock-shaft and Pull-rod Assembly.
Sight-feed Oiler Assembly.
Spark-control Assembly.
Spring Miscellany.
Starting-crank Assembly.
Steering-gear Assembly.
Steering-reach-rod Assembly.
Transmission Unit Assembly.
Transmission-brake Assembly.
Wheel Assembly (Front).
Wheel Assembly (Rear).

The majority of these groups will be found on any gasoline car and the parts included in any of them are not too numerous to handle readily. So if we should take each of these groups and name the principal parts which compose it, the rest would follow easily enough.

Location as Distinction in Terms

The smaller parts, which differ more in the various cars than the larger ones, can be named by a system somewhat as follows: Where there are several parts which are very similar (perhaps performing the same functions on opposite sides of the car), they can often be distinguished by their location in the car. These locations should probably be referred to from the point of view of a person sitting in the car, facing forward. Common words of location are: *Front and rear, right-hand and left-hand, upper and lower,* etc. Usually the smaller parts can be named after the part or parts they are used with. This applies to shafts, bushings, washers, collars, bolts, nuts, studs, pins, pipe-plugs, oil and grease cups and similar small parts. Where several small parts somewhat alike are used with the same large piece, distinguishing prefixes can usually be readily thought of, such as: *Long, short, large, small, round, square, castellated, flanged, lock, retaining, thrust, felt, rubber,* etc. A standard set of such locating and distinguishing terms can probably be developed.

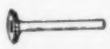
The foregoing suggestions will be of little practical benefit unless some method can be found for collecting and arranging standard terms and bringing them into general use. It has been suggested that a committee be appointed to take this matter in hand, and that it should have enough members that the work can be divided, each covering some small field. The list of standard names should, of course, include at least the principal parts of all kinds of gasoline, electric and steam automobiles.

After these lists shall have been compiled and approved by the society, it is proposed that they shall be printed in the form of a pamphlet, each piece being illustrated by a sketch, so as to make identification certain. A method of arrangement of names and sketches is illustrated in the following "Cylinder Assembly List," taken from the Parts List before referred to; by courtesy of the Chalmers Company.

Possibly volunteers for this work of parts naming can be found among the chief draftsmen of the larger automobile companies; for probably there is no place where standard names for automobile parts will be more appreciated than in the larger drafting-rooms, where new men must be constantly broken in to work according to the necessary rules.

The repair departments of all automobile companies will appreciate this work. For with this "dictionary" in the hands of the engineering department and in the hands of every agent, and of every motor car owner, it is clear to see that an endless amount of confusion will be avoided in the placing and filling of repair orders.

The following should be sufficient to arrest the attention of the society to the matter, which is the only object of this paper. Very likely the work may with advantage be extended so that adopted nomenclature will include a set of definitions of the more common automobile terms and phrases.

Sketch.	*Name.*	*Sketch.*
	CYLINDER ASSEMBLY.	
	Cylinders en bloc.	
	Cylinder priming cock.	
	Inlet manifold.	
	Inlet manifold pipe-plug.	
	Inlet manifold bolt.	
	Inlet manifold bolt lock-washer.	
	Inlet manifold-flange bolt.	
	Flange bolt lock-washer.	
	Inlet valve.	
	Inlet valve-cage.	
	Inlet valve-cage gasket.	
	Inlet valve-cage nut.	
	Exhaust valve.	
	Exhaust valve-guide.	
	Exhaust valve-bonnet.	
	Exhaust valve-bonnet plug.	
	Valve spring.	
	Valve spring-seat.	
	Valve spring-seat—recessed.	
	Valve spring-seat, recessed, split washer.	
	Exhaust manifold stud.	
	Exhaust manifold stud nut.	
	Manifold stud lock-washer.	
	Exhaust manifold gasket.	
	Spark-plug.	
	Spark-plug gasket.	
	Piston.	
	Piston-ring.	
	Piston-pin.	
	Piston-pin set-screw.	
	Fan-lever stud.	

Cork Inserts for Automobile-Making Machinery

Paper Read by LAWRENCE WHITCOMB, at the Detroit Convention of the Society of Automobile Engineers.

EVERY element of cost entering into the production of a motor car is an important factor. Therefore, the following in regard to the use of cork inserts is worth consideration.

An economical, efficient and almost indestructible means of eliminating losses in power transmission is a matter of interest.

Leading engineers have repeatedly made the statement in engineering publications that the amount of power lost in mills and factories, between its source and the point of delivery, through the slipping of belts and other friction devices, is far greater than is usually supposed, in some cases running as high as 30 per cent.

Automobile factories in which, owing to the constant growth of the industry, changes and additions are made from time to time, undoubtedly contain many places where there exists such loss of power, which should be eliminated by the purchase of new pulleys or the corking of existing pulleys.

Cork is made up principally of an aggregation of minute air cells, having thin, air-tight, water-tight and very strong walls. If compressed, the resistance to compression continually grows stronger, in a manner more like the resistance of a gas under compression than that of an elastic solid, such as a spring.

It is the elasticity of cork, coupled with its high coefficient of friction and its remarkable ability to withstand heat and wear, which makes it a valuable material for frictional purposes when used under compression as an insert. But it is a peculiarity of cork that while having much elasticity and strength when confined under pressure, it is brittle when not so compressed; and the very grade of cork that proves to be most indestructible when used under compression as inserts, wholly fails, owing to its brittleness and other peculiarities, if used for frictional purposes in its normally expanded and thus weakened condition. It is this fact that has made its successful use for frictional purposes impracticable until the present method of using it under compression was devised.

To obtain this desired compression, sockets are drilled or cast in the face of a pulley, clutch or brake to be thus equipped, and into these sockets are forced corks of a certain grade and of much larger diameter than the sockets themselves. The corks are allowed to dry and are then trimmed and finished so as to have the right amount of projection above the surface of the material surrounding them.

The amount of this projection depends on the nature of the work required of the friction surface. There are, however, two distinct methods of construction.

Consider first the so-called all-cork contact. In this method of construction the sockets are so spaced that the corks occupy a relatively large area and the corks are allowed to protrude above the surrounding surface one-sixteenth of an inch or more, so that they alone come in contact with the opposing surface and transmit all the power. This drive is most efficient and satisfactory where power is transmitted by means of a large area of cork used at light pressure, as is customary on the frictions of looms and similar machinery and in certain types of plate and multiple disc automobile clutches. In this service the pressure and the power transmitted per square inch of cork are so small that there is practically no wear upon the corks, and thousands of automobile and loom clutches thus fitted have been in constant operation for years without requiring repairs.

Second, the so-called composite construction. In this method of construction the corks are allowed to protrude above the surface of the material, in which they are embedded, but one thirty-second of an inch, as in the case of pulleys, automobile clutches, street railway brake-shoes, etc. This method gives an almost indestructible combination surface, of high frictional efficiency and great wearing qualities. At low and medium pressures the corks, with a coefficient of friction of say 0.35, work alone; while at high pressures the inserts are compressed into their sockets, and the surrounding metal, wood or fibre, also comes into engagement to supplement and protect the corks.

Under these conditions the tendency of the cork to yield to compression is greater than its tendency to wear, and when the pressure applied overcomes the rigidity of the cork, the inserts are pressed into their sockets practically flush with the face of the pulley or other friction surface in which they are set, but do not lose any of their efficiency, up to their full frictional limit, since they remain in contact with the opposing surface and present the same face area as before they were compressed. This tendency of cork to submit to compression and thus protect itself from wear is undoubtedly the reason for the excellent wearing qualities of combination surfaces in which the corks occupy a sufficient proportion of the frictional surface to render efficiently the service for which they are installed.

Two important facts to be remembered are that it is the compression of the cork in the sockets which causes them to protrude again above the metal, wood or fibre surface, in which they are embedded, whenever the opposing surface is released; and that the natural physical properties of this material are such that rapid wear is almost impossible.

That cork inserts used under the so-called composite construction will withstand heaviest loads, constant abuse and excessive heat, is shown by their present use in more than 40,000 motor car clutches and by the adoption of this construction by more than sixty automobile manufacturers.

Having treated the matter rather generally, let us now consider how cork inserts are applicable to the automobile manufacturing industry.

Practically all your power is transmitted by means of pulleys driven by belts, and it is generally acknowledged that the capacity of a belt of given dimensions is greater than the capacity of the pulleys over which it runs; therefore, pulleys having high frictional efficiency are most desirable.

The loss that occurs from the slipping of belts reduces product, reaches back to the coal pile and means waste, while on the other hand the failure of certain machines to operate at the desired speed means loss, and in some cases a defective product.

To eliminate these difficulties, pulleys are lagged and relagged, belts are run under excessive tension to the injury of the belt and with an increase in journal friction far beyond economical operating conditions, and belt dressing is purchased—sometimes in large quantities and to an extent that means an appreciable yearly charge to expense account.

If cork inserts are used in pulleys such lagging, excessive belt tension and belt dressing are unnecessary.

That the cork insert pulley exceeds all others in efficiency is shown by tests made by Prof. C. M. Allen, M. S., at the Worcester Polytechnic Institute, a full report of which is too voluminous for this paper, but from which report we copy the following extracts:

"The object of these tests is to compare the relative power-transmitting properties of the various standard pulleys with those of iron and wood pulleys fitted with cork inserts. The standard pulleys used were the smooth iron-face pulley and the ordinary wood pulley.

"All of the pulleys were new to start with, but were in prime running condition when the principal tests were made.

"The belt used was leather and was kept in good running condition during the test.

"The belt speed was about one thousand feet per minute; the revolutions per minute of tested pulley were about two hundred.

"The conditions of atmosphere were such as to give a good variety of tests, being made during the months of July and August.

TABLE OF RESULTS

Load on Dynamometer	Per Cent. Slip: Iron with Cork Inserts	Per Cent. Slip: Iron
105.0	0.00	1.30
115.0	0.10	1.37
125.0	0.18	1.44
135.0	0.28	1.51
145.5	0.38	1.58
155.0	0.47	1.65
165.0	0.56	1.72
175.0	0.65	1.79
185.0	0.74	1.86
195.0	0.83	1.93
205.0	0.92	2.00
215.0	1.01	2.06
225.0	1.12	2.13
235.0	1.19	2.20
245.0	1.28	2.26
255.0	1.37	2.33
265.0	1.46	2.40
275.0	1.55	2.50
285.0	1.64	2.60
295.0	1.75	2.73
305.0	1.86	2.88
315.0	2.00	3.03
325.0	2.18	3.18

"From the average results of over one hundred tests, the iron pulley with cork inserts at a point of 2 per cent. slip (which is considered allowable in commercial practice) shows a gain in power-transmitting capacity of 51 per cent. over plain iron pulley."

Subsequently to the above reported test it was deemed advisable to make a test of the relative efficiency of several types of small high-speed motor pulleys; and again tests were made by Prof. Allen. The pulleys were all five inches in diameter with three-inch face, and were: (1) Cast-iron, (2) cast-iron with cork inserts, (3) fibre faced with cork inserts.

Appended is the table of results showing the relation between slip in per cent. and horsepower transmitted by the various pulleys tested by Prof. Allen. This table was made up from curves.

Horsepower	Per Cent. Slip: Cast-Iron	Per Cent. Slip: Cast-Iron and Cork	Per Cent. Slip: Fibre and Cork
1	0.23	0.217	0.155
2	0.46	0.43	0.310
3	0.70	0.65	0.465
4	0.95	0.86	0.620
5	1.20	1.085	0.775
6	1.50	1.30	0.930
7	1.85	1.55	1.085
8	2.35	1.80	1.240
9	3.35	2.10	1.395
10		2.43	1.55
11		2.85	1.72
12		3.40	1.90
13			2 12
14			2.35
15			2.70
16			3.18
17			3.95

As certain parties in Lowell, Mass., wished to have a demonstration of the comparative efficiency of cork insert pulleys and pulleys not so equipped, and did not care to rely on the laboratory tests reproduced in part above, it was decided to run a series of tests at the Lowell Textile School, and to invite agents, superintendents, engineers and all other interested parties to participate.

The report in part follows:

"The pulleys tested were all eighteen inches in diameter, six inches face, and were of the following types:

(A) Wood-rim pulley.
(B) Wood-rim pulley, with cork inserts.
(C) Wood-rim pulley, lagged with leather.
(D) Steel pulley.

"The initial belt speed in all tests was about 1,560 feet per minute, and the initial belt tension was approximately 50 pounds per inch of width of belt.

"The comparison of power transmitted at 2 per cent. slip, which is considered a commercial allowance, is given in the first column of the following table:

Type of Pulley	H.P at 2 per cent. Slip	Maximum Horse-power Trans-mitted	Slip in per cent. at Maxi-mum H.P.	Relative Value 2 per cent. Slip
Wood-rim pulley with cork inserts	11.8	13.2	4.6	100 per cent.
Wood-rim pulley, leather lagged	8.7	12.4	4.7	73 "
Steel pulley	8 3	12.7	6.0	70 "
Wood-rim pulley	7.8	9.6	4.3	65 "
Percentage of gain of wood-rim pulley with cork inserts over same without inserts				51 "
Percentage of gain of wood-rim pulley with cork inserts over plain steel pulley without inserts.				42 "
Percentage of gain of wood-rim pulley with cork inserts over leather-lagged pulley without inserts				35 "

"Other tests were made, which would indicate that the percentage of gain for the cork insert pulleys under conditions of less belt tension than that maintained throughout these tests would be even greater than shown above.

"(Signed) G. H. PERKINS"

The several reports from which these quotations are made show that main driving pulleys, receiving pulleys and motor pulleys, and, in fact, all pulleys which may be overloaded or on which slipping may occur will yield better service if equipped with cork inserts than otherwise.

Both wood pulleys and wood-rim iron-arm and hub pulleys now in use may be equipped with cork inserts.

Variation of Current Practice in Anti-Friction Bearings

PAPER READ AT S. A. E. CONVENTION BY D. F. GRAHAM, MEMBER SOCIETY OF AUTOMOBILE ENGINEERS

BY anti-friction bearings is meant ball or roller bearings. This paper is not a discussion of the relative merits of bearing types, but a summary of the variation of sizes in use in present models of cars, so far as it has been possible to secure data. An accurate comparison of ball with roller bearings is impossible at the present time, as there is no accepted standard of measure common to both. This paper is therefore largely confined to a comparison of annular ball bearings.

Where a comparison of the cup and cone type is made, the size of the balls only is recorded, and no account is made of the number of balls in each bearing.

In averaging bearings it is essential that a common dimension be secured—the 300 size is used as standard, the 200 sizes reduced to 300 by the subtraction of 2, and the 400 sizes by the addition of 2. This gives a very nearly correct basis for comparison, namely, the load carrying capacity of the bearings.

There has been received from the various parts manufacturers a number of layouts of axles and gear-sets, but in most cases the horsepower allowed for each type was omitted; so no comparison of these could be given.

There is great need of standardizing plain bearings for motors, as to shaft diameter, thickness and length of bearings, etc. At the present time there are about as many sizes as designers.

In the following tables it seemed best to group the cars according to weight, each group including cars of no greater variation than 500 lbs. In the maximum and minimum columns only the bore of the bearing is taken into account, as giving the most important information, viz.: the shaft diameters.

The tables will show a wide variation in bearing sizes for cars of the same weight and power. An analysis of the conditions which surround some of these variations shows that in most cases where a large bearing is used, it is either on account of a peculiar construction, or in an attempt to use a single row annular where others use an annular and thrust or a double row combined thrust and radial. This practice not only makes the housings and all parts larger and heavier, but also costs more.

There are certainly great possibilities from both an engineering and a manufacturing standpoint in the selection of proper bearings for each place in the car, not only as to size, but as to type.

Another distinct advantage arising from the standardizing of bearings would be from the fewer sizes manufactured, the larger stock carried of each size and more rapid filling of rush orders.

GROUP 1—CARS UNDER 1500 LBS.

Three models—Hupp, ABC (Model K), Duryea Buggyaut.

Type of Bearings—Annular, and cup and cone, 1; roller, and cup and cone, 1; cup and cone, 1.

Position	Size Max.	Min.	Average
Front wheel, outside	7-16" Balls	3-8" Balls	17-32" Balls
" " Inside	9-16" "	1-2" "	17-16" "
Semi-floating rear axle, outside	1-2" "	1-2" "	1-2" "
Differential	1-2" "	1-2" "	1-2" "
Drive pinion	9-16" "	9-16" "	9-16" "
" "	305 Annular		

GROUP 2—CARS 1500 LBS. TO 2000 LBS.

Halladay (Models E, F & G), Pioneer (Model B), ABC (Model O), Regal (Model F), Overland (Models 39 and 40), Franklin (Model G), Currier (Models 10, A and 1).

Type of Bearings—Annular, and roller, 2; annular, and cup and cone, 5; roller, and cup and cone, 3; roller, 1; cup and cone, 1.

Position	Size Max.	Min.	Average
Front wheel, outside	1-2" Balls	1-2" Balls	1-2" Balls
" " Inside	5-8" "	5-8" "	5-8" "
Semi-floating rear axle, outside	406	406	308
Differential	207	207	305
Drive pinion	307	307	301
Transmission, rear	307	307	307
" Front	209	208	306.6
" Countershaft	305	305	305

GROUP 3—CARS 2000 LBS. TO 2500 LBS.

Twenty-nine Models—Buick (Models 19 and 2), Chalmers (Model K), Corbin (Model 18), Franklin (Models D, K, L3 and L4), Moline (Model M), Ohio (Models 40 B, 40 C, 40 D, 40 G and 40 F), Overland (Model 42), Selden (Model 29), L-Stevens (Model 15-30), Maytag (Models D, E and F), Armleder, Firestone-Columbus, Inter-State, Parry, Marathon (Model M 10), Vickers, Warren-Detroit, Stevens (Model 9).

Type of Bearings—Annular, 6; annular, and roller, 5; annular, and cup and cone, 13; annular, roller and cup and cone, 3; roller, and cup and cone, 2.

Position	Size Max.	Min.	Average
Front wheel, outside	307	305	305.4
Front wheel, inside	309	307	307.6
Rear wheel, outside	211	306	306.8
Rear wheel, inside	311	308	309.3
Semi-floating rear axle, outside	308	407	309.5
Differential	214	208	308.8
Drive pinion	309	406	307.5
Drive shaft, front end	211	406	307.8
Transmission, rear	308	307	306.8
Transmission, front	210	306	306.5
Transmsision, countershaft	306	205	305.1

Cup and Cone

Position	Size Max.	Min.	Average
Front wheel, outside	5-8" Balls	7-16" Balls	33-64" Balls
Front wheel, inside	3-4" "	5-8" "	11-16" "
Rear wheel, outside	1-2" "	1-2" "	1-2" "
Rear wheel, inside	3-4" "	5-8" "	41-64" "
Differential	3-4" "	1-2" "	9-16" "
Drive pinion	3-4" "	1-2" "	35-64" "

GROUP 4—CARS 2500 TO 3000 LBS.

Thirty-one Models—Oakland, Alco (Model 7-16), Apperson (Models O, M and 4-30), Buick (Model 17), Stoddard-Dayton (Models 11A, 11C, and 11S), Elmore (Models 36 and 40), Franklin (Model H), Knox, Moline (Model K), Selden (Models 35T, 35S, 35P and 35R), Great Smith (Models D, A, O and B), Stearns (Model 30-60), Croxton-Keeton (Model K), Sterling (Model O), Gabriel (Model 30), Cino, McCue (Model X), Devan (Model 106), Rider-Lewis (Model 8), Wisconsin.

Type of Bearings—Annular, 9; annular, and roller, 8; annular, and roller and cup and cone, 3; annular, and cup and cone, 7; roller, and cup and cone, 4.

Position	Size Max.	Min.	Average
Front wheel, outside	306	404	305.8
Front wheel, inside	308	307	307 5
Rear wheel, outside	311	209	308.6
Rear wheel, inside	312	209	309.8
Semi-floating rear axle, outside	309	408	309.8
Differential	214	208	309.8
Drive pinion	311	307	308.3
Drive shaft front end	209	307	307.1
Transmission, rear	212	306	307.4
Transmission, front	212	308	308
Transmission, countershaft	307	305	305.6

Cup and Cone

Position	Size Max.	Min.	Average
Front wheel, outside	5-8" Balls	5-8" Balls	5-8" Balls
Front wheel, inside	3-4" "	3-4" "	3-4" "

GROUP 5—CARS 3000 LBS. TO 3500 LBS.

Twenty Models—Alco (Models 11 and 12), Apperson (Models 4-50, 4-40, 6-50 and Jack Rabbit), Stoddard-Dayton (Models 10A, 10C, 10F, 10K, 11F and 11K), Rainier, Matheson (Model 6-18), Olds (Models 22L 22AB and 24AB), Pope-Hartford (Models S and T), Gaeth (Model 31).

Type of Bearings—Annular, 7; annular, and cup and cone, 5; roller, and cup and cone, 6; roller and plain, 2.

Position	Size Max.	Min.	Average
Front wheel, outside	307	304	305.8
Front wheel, inside	309	308	308.1
Rear wheel, outside	211	209	310.4
Rear wheel, inside	312	310	311
Semi-floating rear axle, outside	312	311	311.5
Differential	312	209	310 1
Drive pinion	311	405	308.8
Drive shaft, front end	308	307	307
Transmission, rear	309	307	307.6
Transmission, front	210	308	308
Transmission, countershaft	308	305	306.3
Jackshaft (chain drive), outside	311	307	309
Drive pinion, inside	306	305	305.5
Transmission, end of broken shaft	305	304	304.5

GROUP 6—CARS 3500 LBS. TO 4000 LBS.

Ten Models—Alco (Models 9-60 and 12-40), National (Model 40), Olds (Models 22 and 23), Stevens-Duryea (Model S), Thomas (Models M, R and F), McCue (Model 30).

Type of Bearings—Annular, 4; annular and roller, 3; annular, roller, and cup and cone, 2; annular, and cup and cone, 1.

Position	Size Max.	Min.	Average
Front wheel, outside	406	404	307
Front wheel, inside	310	308	309.2
Rear wheel, outside	212	308	309
Rear wheel, inside	312	310	311.1
Differential	312	311	311.2
Drive pinion	411	309	311.5
Drive pinion, inside	406	306	307.3
Drive shaft, front end	309	209	308
Transmission, rear	310	308	309.1
Transmission, front	212	307	308.5
Transmission, countershaft	310	306	308

GROUP 7—CARS 4000 LBS. AND OVER

Five Models—Royal Tourist (Model M), Welch, Thomas (Model K), Allen-Kingston, Houpt-Rockwell.

Type of Bearings—Annular, 3; annular and roller, 2.

Position	Size Max.	Min.	Average
Front wheel, outside	307	307	306.3
Front wheel, inside	309	408	309.6
Rear wheel, outside	211	308	308.6
Rear wheel, inside	311	310	310.5
Differential	314	310	311
Drive pinion	310	310	310
Drive shaft, front end	308	308	308
Transmission, Rear	311	310	310.2
Transmission, front	214	209	310
Transmission, countershaft	407	307	307.5

GROUP 8—TAXICABS

Three Models—Ewing, Croxton-Keeton, Rockwell.

Type of Bearings—Annular, 1; annular and roller, 1; annular and plain, 1.

Position	Size Max.	Min.	Average
Front wheel, outside	406	306	307
Front wheel, inside	409	308	309.5
Rear wheel, outside	210	210	308
Rear wheel, inside	310	310	310
Semi-floating rear axle, outside	408	408	310
Differential	212	309	309.3
Drive pinion	308	308	308
Drive shaft, front end	307	307	307
Transmission, rear	209	209	307
Transmission, front	309	309	309
Transmission, countershaft	307	307	307

GROUP 9—ELECTRICS

Eight Models—Baker (Models P, S and V), Babcock (Models 5, 6, 11, 12 and 14).

Type of Bearings—Annular, 7; annular and roller, 1.

Position	Size Max.	Min.	Average
Front wheels, outside	304	302	302.8
Front wheels, inside	307	306	306.6
Rear wheels, outside	302	302	302
Rear wheels, inside	307	307	307
Motor	306	305	305.6
Countershaft	208	306	306
Semi-floating axle, outside	309	307	307.7
Semi-floating axle, inside	306	306	306

Summary

Total Number Models: 121

Type of Bearings

Annular	37	30 per cent.
Annular and roller	22	18 per cent.
Annular, roller, and cup and cone	8	7 per cent.
Annular and cup and cone	32	26 per cent.
Annular and plain	1	1 per cent.
Roller	1	1 per cent.
Roller and cup and cone	16	13 per cent.
Roller and plain	2	2 per cent.
Cup and cone	2	2 per cent.

SUMMARY OF AVERAGES

Group No.	1	2	3	4	5	6	7	8	9
Front Wheel, Outside	...	...	305.4	305.8	305.8	307	306.3	307	302.8
Front Wheel, Inside	...	...	307.6	307.5	308.1	309.2	309.6	309.5	306.6
Rear Wheel, Outside	...	...	306.8	308.6	310.4	309	308.6	308	302
Rear Wheel, Inside	...	...	309.3	309.8	311	311.1	310.5	310	307
Semi-fltg. Rear Axle, Outside	...	308	309.5	309.8	311.5	...	...	310	307.7
Differential	...	305	308 8	309 8	310.1	311.2	311	309.3	...
Drive Pinion	305	307	307.5	308.3	308.8	311.5	310	308	...
Drive Shaft, Front End	...	...	307.8	307.1	307	308	308	307	...
Trans'n, Rear	...	307	306 8	307.4	307.6	309.1	310.2	307	...
" Front	...	306.6	306.5	308	308	308.5	310	309	...
" Cr'shaft	...	305	305.1	305.6	306.3	308	307.5	307	...
Jackshaft, Outside (Chain Drive)	...	...	...	...	309	...	...	...	...
Drive Pinion, Inside	...	...	...	...	305.5	307.3	...	...	...
Transm'n End of Broken Shaft	...	...	...	...	304.5	...	...	...	...
Motor	...	...	...	...	....	...	...	...	305.6
Countershaft (Electric	...	...	...	...	...	...	...	...	306
Semi-fltg. Axle, Inside	...	...	...	...	...	...	...	...	306

Studies in Aviation Theory and Practice

By MARIUS C. KRARUP.

FACTS of experimental observation in connection with the curvatures of aeroplanes and of propellers are slowly grouping themselves in an orderly array in which the mind perceives a certain correlation betokening the genesis of a physical law, as yet unformulated, relating to thrusts applied against the free atmosphere by means of the surface of solids. The facts referred to are those now well established ones which have been mentioned in previous articles, dealing with the varying efficiency in power application according to the varying angles at which planes are moved through the air and according to the varying degree of concavity with which the pressure surfaces of these so-called planes are formed.

It is of course the great mobility of the air which makes it difficult to apply pressure against it. When it is confined, as in pneumatic apparatus, or when other equally mobile gases, such as steam or the products of a hydrocarbon gas explosion, are confined in the cylinder of an engine, no difficulty is experienced in transmitting pressure with great efficiency by means of the expansion or compression of these gaseous media. Whatever difficulty is met relates to their confinement. Their tendency to escaping has to be watched sedulously. But they respond faithfully to the law of Mariotte, returning a given pressure in inverse proportion to the volume to which they have been compressed. What is sought now, for aid in the development of aviation machines, both as to sustentation and as to propulsion, is a corresponding law relating to thrusts against the atmosphere at liberty.

Material is being gathered at the aerodynamic stations which will eventually permit the scientific establishment of the quantitative relations which must exist with regard to velocities, angles of incidence and shapes of the surfaces with which it is sought to apply thrusts against the atmosphere, but while this material is accumulating many persons in all parts of the world are straining their powers of intuition and of "scientific imagination" to anticipate the final disclosure of the complete law—to anticipate it at least qualitatively. A thesis or theory which has assisted the writer in classifying and understanding the facts recorded by various experimenters, and which has served to reconcile them with other observed facts relating to explosions, tornadoes, parachutes, boomerangs, baseball curves and certain sleight-of-hand tricks with cards, all of which phenomena are more or less intimately related to questions of thrusts against the free atmosphere, may perhaps be expressed as follows:

The free atmosphere opposes a resistance to displacement which is in inverse ratio to the density of the displacing body and in direct ratio to the squared velocity of the latter.

According to this theory the efficiency of a thrust applied by means of the surface of a solid and rigid body must depend upon the interposition of a body of more or less securely entrained air between this body and the atmosphere, and the question of angles of incidence and shapes (curvatures) is resolved into a new question as to what angles and what shapes will result in the formation of the most suitable body of entrained air acting as an efficiency-producer between the rigid surface and the highly mobile free atmosphere. Further, the most suitable body of such air should be one in which the gradation of compression, extending from the solid surface toward the atmosphere and determined by shapes, angles and velocities, reaches from a degree of density against which the solid surface can act with efficiency through successive stages to a lower degree of density, approaching that of the atmosphere itself, and of which these outer layers, being adapted to act against the atmosphere, assume the most favorable, presumably the flattest, form, most nearly parallel with the main extension of the pressure surface of the displacing body.

With regard to the direction of the resistance against displacement, it may perhaps be posited that it must be radial to the formation of entrained air, or extending in converging lines from the least compressed toward the most compressed portions of the same. This assumption would go far to explain the shifting of the centers of pressure under aeroplanes which occurs with changes of angles and speeds. The disastrous action of eddies in the atmosphere, which must be supposed to be formations of a rotary character and comprising layers of air of varying density, also seems to be brought into correlation with other facts by this theory.

In the case of aeroplane action it is well understood that the downward or sustentation thrust under favorable conditions greatly exceeds in lifting power the power of the propulsive thrust which causes it, and this has been considered inexplicable under the known physical laws. Assuming, however, under this theory, that the propulsion of the plane at a suitable angle merely causes the air which is in the path of the plane to arrange itself in a succession of what might be called aerial rollers or sliding blocks, which are hindered in escaping rearward by the lowered rear edge of the plane and downward by the action of the law here tentatively and provisionally formulated, it becomes evident that there is no more reason for demanding a power equal to gravitation for sustaining the moving machine than there is for demanding a power equal to sustaining the weight of an automobile for the purpose of moving the automobile over a road surface.

A paraphrasing of the theory makes this even plainer. Instead of speaking of the resistance of the air to displacement as being conditioned by the density and velocity of the displacing body (of which the entrained air is made to form a part, though one constantly renewed), one may formulate the theory with reference to the speed of displacement. It would then be as follows: Free atmosphere yields to displacement with a speed directly proportionate to the density of the displacing agent and inversely proportionate to the speed of the latter.

Now, when the aeroplane is propelled, skin friction causes the adjacent air strata under the plane to roll, in a manner analogous to that of wave formation in the ocean, and the shapes and dimensions of these rolling waves will be determined by the skin friction with the plane, by the intermolecular friction of air and by the chances for escape under the rear edge of the plane (which are again determined by the tilt, shape and speed of the plane). But the mobility and elasticity of air will cause the waves or rolls to form in layers of increasing density toward the axis of each wave, while many minor waves will form a large one as in the ocean, and the forward pressure of the moving plane will flatten and condense the waves on the side from which pressure is received. Assuming now, in accordance with the theory, that the air of a given degree of compression cannot displace air of the next lower degree of compression at more than a certain low speed, and that the velocity of the plane further reduces the speed at which one layer can displace another, it is readily perceived that the plane as a whole simply follows the lines of smallest resistance when it glides forward over the air rollers rather than dropping. No laws of gravitation are violated and no mystery is created, if a law such as formulated, or similar, with regard to the action of one body of air against another, one gas against another, is assumed to exist.

By applying this theory intuitively to all the various phenomena of aviation, the relations between flat and curved, narrow and wide, smooth and rough, flabby and taut planes seem to take on new significance. The accidents seem only natural, and even the somewhat incomprehensible contention of experimenters that a thick front edge reduces resistance to propulsion and increases sustentation begins to look perfectly reasonable—for the kind of planes for which they have found it true.

Abstracts from the 50 Best Foreign Papers

Digest Along Technical Lines for the Engineer

Quick identification of iron and steel materials by means of an emery wheel is the subject on which Erhard Fuchs of Saronno imparts some information more definite than that which is commonly offered. The writer stepped into a position in which he had to make the best of a lot of old steel material lying around the place unidentified as to analysis, price and origin. Trying the method proposed by Max Bermann (and also known in United States) of recognizing each steel by the sparks it emits when ground with an emery wheel, he found it at first difficult to distinguish the various spark figures, but after a little practice the eye grew accustomed to look for the isolated sparks rather than for the densest bunch of them and then it became easy to tell the typical lines resulting from a certain grade or composition of steel. It is advisable to cut off samples of known composition and use them for comparison. Any emery wheel may be used, but in the various trials it should always be of the same grain and hardness, and the wheel should be operated at normal speed, such as 25 to 30 meters per second. It is the metal torn from the sample which forms the spark, as the emery torn off does not reach red heat.

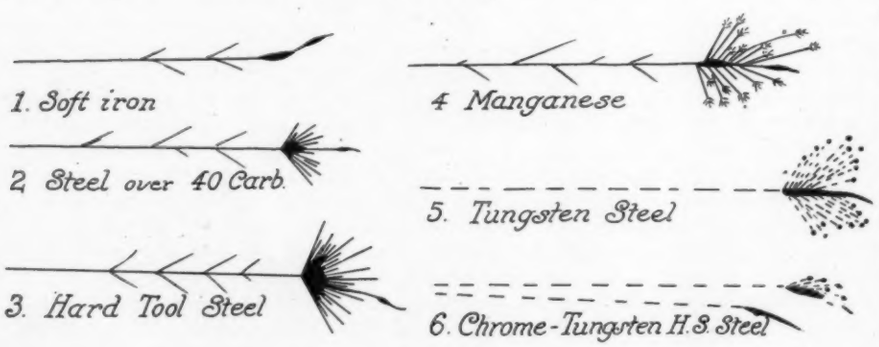
With soft iron, the spark forms a straight line whose end is shaped as an elongated drop which glows very brightly, and immediately in advance of it a smaller drop of dark red is formed. Silicon in the iron adds greatly to the brightness of the spark. When the carbon exceeds 0.40 per cent., small bristles or barbs are observed on the first, bright-glowing drop, as in Figure 2 of the illustration. Harder steel shows a great bunch of these bristling rays, as in Figure 3. Bermann ventures the thesis that the number of small rays is proportional to the carbon contact, and a trial with samples of the tool steel which is usually at hand in a factory and numbered according to hardness permits one to verify this thesis.

With ordinary low-grade tool steel, which is a manganese steel, the ends of the rays on the bright drop are not pointed but fan-shaped, and this fan-shape denotes the manganese content, while the number of the rays denotes the carbon. Tungsten gives rays dashed with dark-red and much elongated drop shapes, and with some of the sparks there are shown, where the drop is brightest, small dotted rays which end in a round ball, as in Figure 5. Strong pressure is necessary with tungsten steel, as otherwise only the dotted lines appear. With high-speed steel in which chromium and tungsten are the principal alloyed ingredients only two kinds of rays occur; thin dark-red ones and thicker ones tile-red. They are in dashes. The spark image of high-speed steel cannot be confounded with that of any other steel type. The sparks move in a peculiar manner. When already a little distance off the work their speed is increased without any visible outside influence. According to the composition of the high-speed steel other rays occur, presumably in correspondence with the contents of titanium, molybdenum or vanadium. By high pressure, the little thin dotted dark-red rays with ball-ends appear now and then.

Cementation steel shows the same image as manganese steel (this seems curious), and from under the hardened surface the same as iron. Cast-iron shows different images, according to its composition, the carbon and the manganese showing as before mentioned. A large number of grey iron samples from different makers gave as many somewhat differing spark figures, but the composition of each was not known. The brightness of the rays varied from dark-red to white and should prove one of the distinguishing means. Many applications of this ready test method should be possible. Old tools of unknown steel may be annealed, worked over and tempered at the right heat. Mixed and unmarked steel may at once be employed for its purpose. Cast pieces obtained in the trade may be compared with analyzed samples. The author expresses a desire that many others will step in and complete his observations.—*Werkstatts-Technik*, May.

If there is a pit under the vehicle in the garage, the danger of fire is no less great, says the author speaking of those accumulations of gasoline in gaseous form to which most garage fires are due. The soil and sides of the pit finally become saturated with inflammable products which are so much more to be feared as they are less in evidence. It is therefore necessary to take certain precautions. Our American colleague, THE AUTOMOBILE, advises a very judicious but rather costly method consisting in establishing a series of air vents in the walls along the level of the floor; there will then be no stagnation of inflammable fumes. The solution is elegant, but, as said, it is costly and, besides, it is uncomfortable for the feet of the mechanic, in wintertime, when he does the daily chores of the machine. It seems to us that the most practical means for avoiding the danger consists in leaving permanently under the vehicle one of those large sheet iron boxes which are used under automobiles exhibited in salesrooms to avoid soiling the floor with oil drippings. A box of this kind should be filled with sawdust and this should be renewed every day. Sawdust, as referred to in previous articles, absorbs a very considerable volume of gasoline and thereby prevents its evaporation. It offers moreover another advantage, as it makes an excellent soap for the mechanic and one which costs next to nothing and does not ruin the hands. Mixed with brown soap it removes grease from the hands, without affecting the skin, better than any other substance whatsoever.—*La Pratique Automobile*, July 10.

Special stresses caused by the use of gyroscopes are not often considered when it is proposed to employ gyroscopic devices for the balancing of automobiles or aviation machines. But light on this subject comes from unexpected sources and shows incidentally, with special reference to aeroplanes, that any attempt to endow them with a high degree of automatic stability, by gyroscopes or any other means, would be accompanied by strains upon the slender materials of these structures which are now obviated through their very mobility in and with the atmosphere. Speaking of the various means proposed for avoiding seasickness by reducing the pitching and rolling of vessels, the author in this case calls attention to experiments made with gyroscopes in British torpedo boats, not for



Typical lines in sparks drawn from various sorts of steel with an emery wheel—the colors are stated in the text

avoiding seasickness, but to enable the gunners to point their deadly ordnance with more unfailing precision than is possible when the sea tosses the ship from side to side. The results, he records, were deplorable. The rolling was diminished, to be sure, but the yielding of the vessel to the waves was so much restricted that the latter broke with extreme violence against its shell and threatened to destroy it. It was considered useless to continue the experiments.—*Omnia*, July 2.

The designer's work is the basis on which the buyer and the business manager must work out their economies. They can seldom add anything to the value of his work, though they are in position to detract from it. Every error of judgment on the part of the designing engineer is most likely to be found in the finished product, while some of the virtues of his conception may have disappeared. The fault lies usually in lack of commercial and producer sense with the designer, but frequently it lies in the vagueness of the problem which he has been asked to work out. He is wanted to produce a certain type of construction "as cheaply as possible," while there should be given him a definite limit in mark and pfennig. His dormant economical sense does not wake up until the problem is clothed in exact figures. A simple matter, such as changing a three-speed transmission into a four-speed transmission, becomes much more interesting to the designer when the extra cost of production involved in the change is limited in advance to a scant sum, say 100 mark. It is true that the means for calculation will usually be accessible only to the designer in chief, and it will remain for him to instruct his draughtsmen in the most practical manner. The work of both will gain in depth, to themselves, and in utility. Working closely to a fixed budget is, moreover, nowadays a method outright necessary for commercial self-preservation. The horn of plenty no longer hangs over the automobile industry, in the sense that novelty, as such, may be presumed to compensate for the expenses due to lack of experience and expensive trials of new devices. There must be profits everywhere. And some decided changes in methods are necessary if the spirit of economy shall find satisfaction without deterioration of the products. It must be admitted that heretofore the decisions of husbandry have been more generous than just. Ignorance of the forces and stresses involved and general lack of experience caused the admission of high-priced materials in many instances when its adoption would not be justifiable to-day. Sometimes it was timidity and indecision which promised safe results with the expensive materials. And often it was reserved for the nickel-chrome steel at 1 1-2 mark per kilogram to cover up all sins of construction, and where the costly customer had once found lodgment it was always difficult to unseat him, always a matter of scrupulous hesitation. Few wish to retrograde in materials. For this reason the slowly rising new firms are as a rule working on a more rational economical basis than those who shared the blessings of the cornucopia period.

Taking bar material as an example, there may be differentiated between the following groups, among which the normal open-hearth (Siemens-Martin) steel at 15 to 16 mark per 100 kilogram may be considered as the unit value.

Tensile strength per square millimeter	Elongation		Price Scale
1. Open hearth steel, 40 kg.	28%	Casehardening material	1
2. Open hearth steel, 45 kg.	22%	Forging steel	1
3. Open hearth steel, 50 kg.	15%	Tempers by quenching	1
4. Open hearth steel, 55 kg.	25%	Casehardening material	1 1-2
5. Open hearth steel, 60 kg.	25%	Casehardening material	2 1-2—3
6. Nickel steel, 75 kg.	20%	Tempers by quenching	3 1-2—4
7. Nickel-chrome steel, 80 kg.	18%	Casehardening material	6
8. Nickel-chrome steel, 95 kg.	15%	Casehardening material	8
9. Nickel-chrome steel, 110 kg.	8%		10

This makes nine different qualities to work with, and the first impression of this fact is deterring. The subdivisions are, however, justified, even at first glance, by the great price difference of the last material, which costs ten times as much as the first. This expensive material cannot be quite dispensed with for good automobiles, but it is of course advisable, wherever this material can be spared, to fall back upon a cheaper one, and on this basis even slight variations in the grades bring important economies. A bar of 50 millimeters diameter weighs about 15 kilograms per running meter. The difference in price by going from No. 9 to No. 8 involves two steps in price or 30 pfennig per kilogram. For one meter of material there is already 4.50 mark saved, and by choosing No. 7 the saving reaches 9 mark for one piece in the construction. In many instances attempts at economy of this order fail only because there are not enough intermediate grades, while it is not feasible to fall back as far as to No. 5. The lack of intermediate grades has been the rule until recent years. The material jumped from No. 4 to No. 8, and this fact conditioned a qualitative difference between the high-grade and the low-grade car. But to-day the steel mills furnish materials at prices from 0.50 to 0.80 mark of very excellent medium quality. With these on hand, the use for general construction of the top notch quality, which is intended only for special purposes, is sheer waste. The number of grades can therefore not be reduced without notable industrial losses. (The author's reasoning can of course not be properly applied to American industrial conditions without considerable modifications, in which the position of the partsmaker and the cost and difficulties in getting proper casehardening and heat-treatment for a large number of different kinds of steel in one factory are among the factors to be considered.)

Another factor in economy is frequently ignored. Many designers are still fired with an exaggerated ambition for light weight and sacrifice considerable differences in price for slight gains in this respect. It has become possible to-day, by reason of the developments of the foundry technic and the processes of mass manufacture, to build very light by the employment of tubular and pressed-steel parts and without any use of expensive materials. It is quite conceivable in some instances to change from No. 8 to No. 1, by considering elements which have been carried into new constructions year after year without new examination as to their fitness under changed industrial conditions. Let us consider a camshaft of 18 millimeters diameter, material No. 8. I use instead material No. 4, price 1 1-2. The strength is perhaps 30 per cent. smaller, so that I must choose a larger dimension. I go to 25 millimeters diameter. That makes the rigidity of the new shaft 1534 as against 572.6 for the old, so that safety no doubt is taken care of (with all allowance for fatigue due to alternation of stresses). The increase in weight amounts to 1.998 kilograms per meter. The saving in cost comes to 97 pfennig per kilogram, and, as the size of the cams renders integral cams desirable, the weight to be considered is that of a bar 50 millimeters in diameter and one meter long, which weighs 15 kilograms; cost saving 14.55 mark. By this saving the increase of 2 kilograms in weight should be justified, especially as it may be offset at other points. For example, a forged step bracket weighs about 2 1-2 kilograms, while a tubular one or one made of pressed sheet steel can be produced at a weight of 1 1-2 kilograms each, which for four brackets means a weight saving of 6 kilograms, aside from the price saving on the brackets. It is easily seen how fruitful a systematic examination of the possibilities extending to every piece of the whole construction may become, particularly if shared in by both the designer and the business manager or producing engineer. With these possibilities properly exploited, an economical decision at one point will frequently lead to an outright improvement in the whole construction. The saving safely effected at one point permits one to spend a little money at some other point which may have proved itself of doubtful security in practice. Out of the 14.55 mark saved on the camshaft, 4.55 mark, say, may be employed for such a purpose, and yet a saving may be recorded on the whole. The general rule of proceeding at every step with a specific examination of the possibilities applies of course to all materials in a car and not only to the question of adoption or non-adoption of the extra high-priced steels. Too much attention cannot be given to the fact, almost forgotten in some circles, that "common steel" after all offers tensile strengths as high as 50 kilograms per square millimeter with an elongation of 20 per cent.—From unfinished article by Diplom-Ingenieur N. Stern in *Der Motorwagen*, June 30.

The Carrying of Tools, Spare Tires and Supplies

Extracts from Paper Read at S. A. E. Convention by H. H. BROWN, Member Society of Automobile Engineers.

Cleanliness, convenience and economy demand that there be a radical change from the present practice of carrying lubricating oil, tools, spark plugs, spare tires, etc. The author points out several practical methods of so doing which the the autoist could follow with advantage.

WHILE it may seem to some that the consideration of the matter of carrying tools, tires and other accessories and supplies on a machine are beneath the notice of an engineer or designer, the subject is one which means a good deal to the comfort and convenience of both the passenger and driver. The designer should, in the course of time, overcome all of the weak points of the motor car. In the meantime, repairs of one kind or another must be made on the road. Than the engineer no one is in a better position to know what tools are most suitable for these repairs, and to state what shall be the outfit of the car in this respect, and to him this paper is particularly addressed.

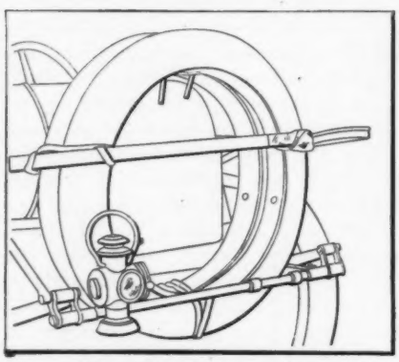


Fig. 1—Demountable-rim carrier on Alco car in 1909 Vanderbilt Cup race

Even granting that any car in question is perfect, yet the puncture fiend is always likely to be with us, and spark plugs will occasionally go out of business. Our prominent designers are, above all, practical men, having perfected their designs by good, thorough road try-outs. During this work, doubtless, many little ideas which would greatly minimize the time taken for a roadside repair have come to them, only to be put aside in the rush of more important details.

One point that might easily be improved is the method of carrying lubricants. It is an open question whether there is nowadays any necessity of carrying a reserve supply of lubricants at all, other than that which is carried in the squirt-can for immediate use. However, on a long tour, while well-equipped garages at which oil of a good quality may be had are now available almost everywhere, a driver cannot be blamed for liking to stick to a brand of engine lubricating oil in which he has confidence. Therefore, a reserve supply of a gallon is a good thing to fall back on in case a particular brand is not available.

No particular place seems to have been chosen by either makers or users for carrying this reserve supply. The action of oil on rubber needs no comment. Oil cans are almost certain at some time to leak; or, if they do not, in pouring the oil to the motor or squirt-can, some of it will almost invariably slop over, and the chances are strongly against the can being wiped perfectly dry before being replaced in whatever storage place is assigned to it.

From this point of view the tool box on the running board is not so bad a place in which to carry this oil reserve. But one does not care to get the hands more or less covered with oil, whenever a tool is required for some simple adjustment such as removing a spark plug. A step in the right direction was made by a well-known dealer in oils. This maker provided, free to consumers, a little bracket, complete with strap, which could be affixed to the running board. Even if the can should spring a leak, the greatest damage that could result would be a slippery running board; and a liberal dose of sand or dust would easily remedy this fault.

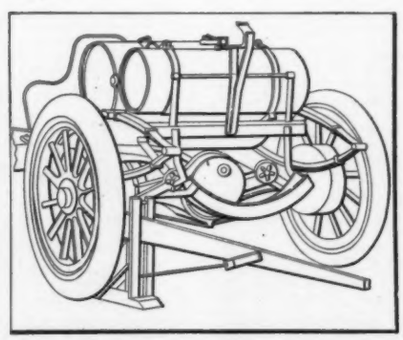


Fig. 2—Demountable-rim carrier on Marmon car in 1909 Vanderbilt Cup race

However, the best place for carrying the supply of reserve motor lubricant is either under the motor bonnet or under the floor boards. In either of these positions it would be near the place of use, would occupy room practically available for no other purpose, and in event of leakage, could do no damage. Of course, it might in some cases be necessary for the maker to provide a can of a special form, and with suitable brackets and fastenings, for holding the same securely in position.

The position and method of carrying tools should be such as to be of the greatest convenience to the driver and of the least annoyance to passengers and others when it is necessary to get at the tools, etc.

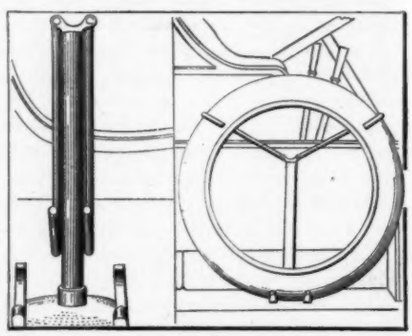


Fig. 5—G. P. M. demountable-rim carrier

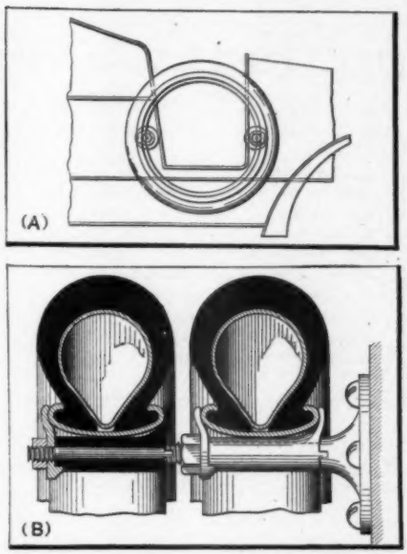
Following this principle to its logical conclusion, the best place, if both places above indicated were equally available for carrying the lubricant, would be under the bonnet, out of sight and yet accessible.

For carrying tools the most satisfactory method, when all classes of cars are considered, is in a tool box on the running board. A box formed under the front seat is from many viewpoints an equally desirable place; but in a touring car which employs gravity feed this position is precluded, as it is desirable not to curtail the dimensions of the gasoline tank in order that the distances that one can travel on a filling of gasoline should be as large as possible. The back seat space may be made available for carrying tools and supplies without inconvenience to the rear seat occupants by means of an outside, side or rear door. However, this method has the drawback that things are much more liable to get lost, owing to either theft or leaving the door insecurely fastened.

One of the best methods of carrying tools is in a tray (or trays) having depressions for each individual tool. An experienced driver or mechanic knows in advance pretty nearly what tools are required for a particular job. With the tray system no time is lost looking for them. Then, again, when the job is done, a glance will show whether any tool which may have been left by the roadside is missing, and the same glance will tell by the shape of the depression just what tool it is that is missing. The only thing that can be said against this method is that it wastes considerable room and is, perhaps, somewhat expensive. Another method is the provision of a roll leather kit, with places for each tool. This method has the advantage that all tools can be carried to the vicinity of the job in question, and that a much smaller space is occupied by the tools as a whole. However, much more time will be occupied in getting out and putting away the tools, which are much

more likely to get lost than in the former method.

One point seems to have been given very little thought by the makers: the methods of carrying spark plugs. Many plug makers provide secure mailing cases. As long as a plug is kept in one of these receptacles it matters little how or where it is carried. These receptacles, however, are bound to get lost or misplaced. One good scheme is that a wooden or metal block, threaded for the reception of the plugs, be secured to some part of the machine, in the interior of the tool box, or even under the bonnet. For instance, there might be provided on each cylinder a clip, into which a spark plug could be screwed. This would then act at the same time as a holder, in case one wished to test the spare plug or to test the plug in the cylinder by the method of "parallel gaps."



Figs. 3A and 3B—Demountable-rim carrier, support being applied directly to rim

It is probable that the matter of tire-tool equipment is the one in which American manufacturers have been remiss. The sole tire repair equipment as regards tools until recently was a pump, sometimes of more or less doubtful utility; two plain, straight flat tire-irons, a jack, which was generally too tall to place under the axle when the tire was deflated, and a box which contained a small tube of cement, some minute rubber patches and valve parts. While one can, on a pinch, get along with plain tire irons, yet to handle a clincher tire with facility others are desirable. The number and variety of these are legion, and most of them are good when once the proper method of handling is understood; but some appeal to certain users.

No experienced motorist will think of taking a trip of any length without spare tubes, nor will he rely on a cemented patch, unless he is forced to by stern necessity. Spare tubes should form part of the equipment of all experienced motorists. Careful driving, care and inspection of a modern car will make one practically immune from roadside stops, other than those due to tire troubles, against which no amount of care can entirely guard. The inconvenience of these troubles should be reduced to a minimum. One of the first things to effect this is to make all appliances likely to be needed readily accessible.

For all classes of cars the most convenient place to carry the extra inner tubes is probably the tool box on the running board. If some of the tools and supplies less likely to be used are arranged for in other places than the running board box, then room can be made for spare tubes in the tool box without greatly increasing its size, if at all. In the case of a town car, used as such, even with gravity feed gasoline system, the amount of gasoline needed is so limited as to allow of ample storage space for all tire tools and spare tubes under the front seat. The tire trunk is also a good solution of the spare tube storage space problem.

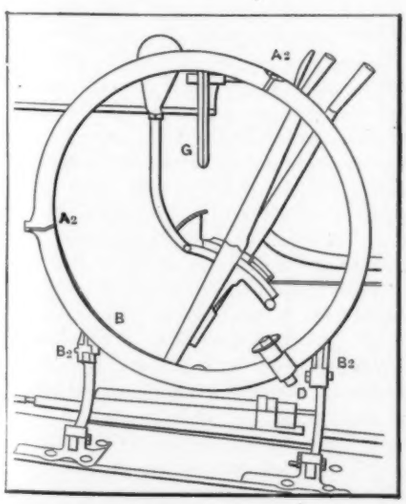


Fig. 4—Dunlop demountable-rim carrier. Pins A_2 and D on outer aluminum ring casting, support rim. Inner casting B is held to running-board by swing brackets B_2, B_2, and to body by shorter swing link G

The introduction of the demountable rim has reduced the number of tools needed on the road for tire troubles to two: the wrench, brace, or key, used in securing the rim to the wheel, and the jack. It is probable that an owner who has had demountable rims fitted to his car will, on getting his first puncture, meet with a good deal of disappointment as to the time required to effect the change. This is owing a good deal to the accounts he has heard of changes being made during races in between thirty and forty seconds.

In the case of a touring car, getting out and putting away tools, especially if they are kept in a locked tool box, will easily take a minute. There is generally one man, only, available for the work, and while he may have a pretty good general idea how to do the job, he has given very little thought as to the best sequence of operations; hence a further waste of time. It may, therefore, be laid down that with identically the same equipment a driver is doing well if a tire change is accomplished in anything like double the time taken by the change on a racing car.

On the Alco, driven by Grant in the last Vanderbilt Race, two tires were carried in the rear in a sort of frame or basket, each within a separate compartment of the frame (Fig. 1) and so arranged that no straps were needed, a tire when inflated fitting its compartment snugly. It is doubtful, however, if this method would be a good one for regular pleasure conditions.

A rather good method was employed on some of the Marmon cars; in this case one tire only being carried. A sort of trough being bent to the same radius as the tire served as a support, the upper part of the tire resting in a shallow Y-shaped piece, and being held securely therein by a single strap. (Fig. 2). This form of carrier has the advantages that it serves equally well to carry without movement an inflated or deflated tire, and requires little time for strapping and unstrapping.

Very little seems to have been done in this country toward the design of a carrier supporting the spares by the rim, although at least two patents have been granted on carriers which use this method. (Figs. 3A and 3B—McMurtry patent). The great advantage of this method lies in the fact that chafing of the tire is entirely eliminated. Figure 4 shows a device of this type marketed by the English Dunlop Company. This device will also serve as a holder while changing tubes, shoes, etc.

Two examples of what may be called automatic or semi-automatic demountable rim carriers are given. Figure 5 shows the G. P. M., in which two hooked arms are pulled down on to the tire by a spring concealed in an upright column.

Figure 6 shows the Rotax, another English device, in which the tire is retained in position solely by its weight. The action will be clear from the cut.

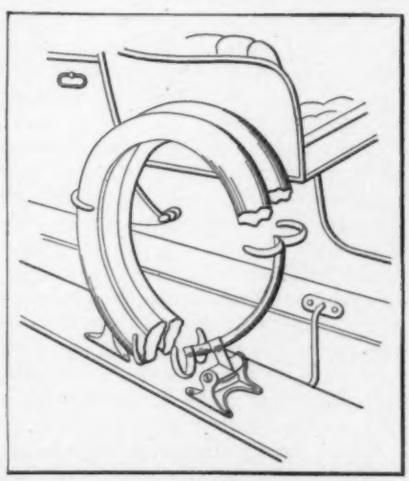


Fig. 6—Rotax demountable-rim carrier

The Pyrometer, Its Development and Use

By WM. H. BRISTOL

Opens with early history of pyrometers of the various types; discusses the laboratory side of the situation; refers to the Le Chatelier pyrometer as an instrument of precision for calibrating purposes; points out the necessity of a more sturdy instrument for practical work; describes the Bristol type of instrument for the purpose.

IN scientific research in the laboratories of manufacturing plants, and in connection with every-day operations in a factory where heat is employed, as in the treatment of steels for parts of an automobile, pyrometers have come to be considered a necessity. In the heat treatment of alloy steels in particular the range of temperature permissible is very narrow, and it is impossible to judge the small ranges of temperature required by the eye. A sensitive and accurate pyrometer, by means of which the product may be duplicated with certainty from day to day, is of the utmost importance. At a large automobile plant which the writer recently visited, the head of the hardening department said he would be unable to do his work without a pyrometer, it being to him what the mariner's compass is to a sea captain.

A man with no experience was placed in charge of a large hardening room with pyrometers connected to the different furnaces, and given directions for using the pyrometers in the treating of steels for the important parts of automobiles. For over a year this inexperienced man has successfully turned out material which has passed through his department.

With pyrometers it is possible to determine by experiment the proper method and temperatures for the working of a particular product to obtain the best results, and afterwards it is a simple matter to duplicate the results.

The thermo-electric pyrometer is the one which is the most generally adopted and in use at the present time, and as the author has made a special study of the development of this particular type of pyrometer, special importance will be given to these pyrometers in this paper.

Before describing and taking up the characteristic features of the thermo-electric pyrometer, brief sketches of different types of pyrometers will be given.

The first practical pyrometer was devised in 1782 by Wedgwood, an English potter, for use in operating his kilns. He depended upon the contraction of clay at high temperatures for his measurements.

In the ceramic industry Seger cones are used, having various degrees of fusibility. There is a tendency of these cones to curl over when certain temperatures are reached, but, of course, they are valueless to show if the temperature has fallen back.

Fusion-point pyrometers have been used, making use of the known melting points of different metals and other substances.

Metallic expansion pyrometers have also been developed in which use is made of the actual expansion of the metals, or the differential expansion of two metals fastened together. In this class of instruments, however, the metals take permanent sets and are not reliable.

Heat conduction pyrometers have also been developed, in which a current of water of known temperature flows at a constant rate through a tube placed in a furnace. The increase of the temperature furnishes a means of measuring the temperature of the furnace.

Specific Heat Pyrometer. If a body of metal of a known weight is transferred from the furnace to be tested and plunged into a quantity of water of known weight and temperature, the increase of temperature of the water will depend upon the temperature in the furnace and is a means of measuring the temperature. This type of pyrometer with a copper ball has been used until recently by very large works.

The air or gas pyrometer depends for its operation upon the expansive force of air or gas when heated to the temperature to be measured. This means of temperature measurement is used as a standard at the present time.

The Optical Pyrometer. In one type of the optical pyrometer the temperature is determined by the photometric measurement of radiations from substances heated. Another type of optical pyrometer depends upon the polarization and refraction of light by means of Nicol prisms.

Reprint No. 11 from Bulletin of United States Bureau of Standards, Vol. 1, No. 2, is on "Optical Pyrometry," by C. W. Waidner and G. H. Burgess, of the Bureau of Standards. In this bulletin different optical pyrometers are described and discussed.

Radiation Pyrometers. Pyrometers of this type have been developed recently by Professor Fery, in which the radiated heat from the body is focused upon a small thermocouple by means of a concave mirror. This type of instrument is being introduced commercially and is especially valuable for the measurement of temperatures above 3000 deg. Fahr., where the platinum, platinum-rhodium thermo-electric couples cannot be used. The introduction of electric furnaces makes this type of instrument particularly valuable.

Electric Resistance Pyrometers. This type of pyrometer was first suggested by Sir Wm. Siemens in 1871. He used platinum wire for resistance wound on clay, but it was found that the silica attacked the platinum, making it brittle. In 1887 Professor Callendar worked out a practical form of the resistance pyrometer with platinum resistance wire mounted on mica, and he developed the plan of using the Wheatstone bridge with a compensating lead which has proven of great commercial value for temperature measurements. The Callendar instruments were of the zero type, and depended upon restoring the balance of a Wheatstone bridge by a handle adjusting resistance. Professor Callendar developed a recording instrument which operated by means of two stops to close the circuit of one or another relay, which in turn operated the carriage for the recording pen. The resistance type of pyrometer is accurate and practical for ranges to 1200 deg. Cent. For the measurement of small changes of temperature it is particularly well adapted. In a paper presented at the Scranton meeting of the American Society of Mechanical Engineers in June, 1905, Dr. Howard F. Barnes, of McGill University, described a pyrometer of the resistance type, in which one degree covered a length of 8 inches on the scale, making it possible to estimate to 1-1/1000 of 1 deg. Cent.. In the resistance pyrometer the limit of accuracy depends on the limit to which resistances can be measured. In the resistance pyrometer for measuring high temperatures only platinum can be used for the resistance element, and therefore the parts that are applied to the furnace are expensive. In this type of instrument there are possibilities of error, due to thermo-electric couples being formed at various junctions and to the heating of the resistance wire by the current used to operate the instrument. It is also important that sufficient immersion be made when the temperature is measured, which is not always convenient to obtain. The construction of the resistance coil necessarily occupies appreciable space and, together with the insulation, produces a time lag that must be allowed for. The resistance pyrometer has its particular field of usefulness.

Reprint No. 124 from Bulletin of United States Bureau of Standards, Vol. 6, No. 2, is devoted entirely to the study of platinum resistance thermometry at high temperatures. This bulletin is by C. W. Waidner and G. H. Burgess, of the Bureau of Standards. In addition to the full description of platinum resistance thermometers there is given a list covering several pages of references to articles on the subject.

The Thermo-Electric Pyrometer

This instrument depends for its operation upon the phenomenon that an electric current is produced when the opposite junctions of two dissimilar metals or alloys are of different temperatures. This law of nature was discovered by Seebeck in 1820. The two dissimilar metals or alloys which are thus joined have come to be known as thermo-electric couples. As stated by Le Chatelier in his book entitled "High-Temperature Measurements," Becquerel was the first to make use of the discovery of Seebeck in applying the thermo-electric couple for measuring high temperatures. He used a platinum-palladium couple. Pouillet, in 1836, carried on further researches with thermo-electric couples. Other scientific experimenters have studied and carried on investigations with thermo-electric couples, using a great variety of metals and alloys to discover a couple which would resist high temperatures, and could be depended upon for constancy for the measurement of such temperatures. It was not until Le Chatelier, after doing a great amount of work with the thermo-electric and optical pyrometers, introduced the thermo-electric couple of platinum, platinum-rhodium that good results were obtained. This couple, which has been most widely used for over twenty years, has come to be recognized as a standard for measurement of temperatures from 300 deg. Cent. to 1600 deg. Cent.

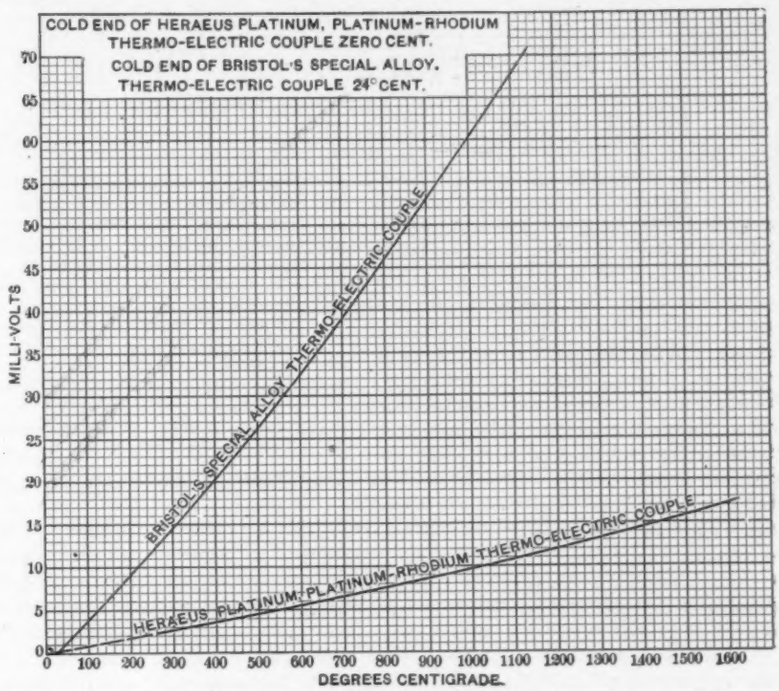

COLD END OF HERAEUS PLATINUM, PLATINUM-RHODIUM THERMO-ELECTRIC COUPLE ZERO CENT.
COLD END OF BRISTOL'S SPECIAL ALLOY. THERMO-ELECTRIC COUPLE 24° CENT.
MILLI-VOLTS
DEGREES CENTIGRADE.
BRISTOL'S SPECIAL ALLOY THERMO-ELECTRIC COUPLE
HERAEUS PLATINUM-PLATINUM-RHODIUM THERMO-ELECTRIC COUPLE
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600

Fig. 1—Pyrometric records of Heraeus and Bristol thermo-electric couple pyrometers, from data given in tables 1 and 2

As thermocouples depend for their operation upon the difference of temperature between the hot and the cold ends, to have a standard basis for comparison, the electromotive force developed by the platinum-rhodium couple is based upon the supposition that the cold end of the couple is maintained at zero Centigrade. The following table No. 1 gives electromotive forces from a standard Heraeus platinum-rhodium couple for different ranges of temperature between 300 deg. Cent. and 1600 deg. Cent.:

TABLE NO. 1

Heraeus Platinum, Platinum-Rhodium Thermo-Electric Couple	
Degrees Centigrade	Electromotive force, Millivolts
...	....
...	....
300	2.31
400	3.24
500	4.21
600	5.21
700	6.25
800	7.32
900	8.43
1000	9.57
1100	10.74
1200	11.95
1300	13.19
1400	14.46
1500	15.77
1600	17.11
Cold end of Couple at Zero Centigrade	

TABLE NO. 2

Bristol's Special Alloy Thermo-Electric Couple	
Degrees Centigrade	Electromotive force, Millivolts
100	4.
200	9.5
300	15.
400	20.08
500	26.
600	32.5
700	39.
800	46.
900	53.
1000	60.05
1100	67.5
....	....
....	....
....	....
....	....
....	....
Cold end of Couple at 24 deg. Centigrade	

The relation between the electromotive force and the temperatures is very clearly shown by the lower curve in diagram No. 1, where the ordinates represent millivolts, and the abscissas degrees Centigrade. It will be observed that this curve is not a straight line, and, therefore, it is not possible to make any absolute rule for the correction that will be necessary when the couple is used with the cold end of the junction at any other temperature than zero Centigrade (freezing water). In practice, where the platinum-rhodium couples are employed in industrial operations it is not generally customary to maintain the cold ends at a constant temperature, or zero Centigrade, and, therefore, corrections should be made for the variation in temperature at the cold end of the thermocouple from zero Centigrade. This correction for the platinum-rhodium couple is approximately plus half of the Centigrade temperature of the cold junction for a limited range, and increases to unity as the temperature of the cold end increases.

From the above figures and curve it will be observed that the platinum-rhodium couple produces only a very feeble current, and, therefore, in order to accurately measure the current of electricity produced by the small electromotive forces for the different temperatures over the range, it is necessary to have an extremely delicate and sensitive instrument. The high-resistance suspension type of instrument has been adopted generally, the high resistance being necessary to eliminate the effects of temperature influence upon the resistance of the elements forming the couple, and upon the leads and coils of the galvanometer itself. For laboratory research and for standardization purposes the Le Chatelier platinum, platinum-rhodium couple with a high resistance galvanometer is the most convenient and accurate apparatus for measuring high temperatures. The delicate suspension galvanometer with the platinum-rhodium thermocouple of the Le Chatelier type may, therefore, be considered better suited for laboratory use than for shop service. The platinum wires are very expensive, and they also require expensive insulating tubes. Where the platinum couples are employed in a commercial way, sufficient attention is not given to taking care of the temperatures at the cold ends of the couple, as they are naturally made as short as possible to save expense, and thus the cold end cannot be carried away from the influence of conduction and radiation from the furnace where the temperature is to be measured. It is, of course, possible to provide artificial means for keeping the cold end of the couple at a constant temperature, but this adds expense, and is very troublesome.

To meet the increasing demand for pyrometers for every-day shop use which would be reliable and comparatively inexpensive, taking into consideration both the initial cost and the cost of maintenance, the low resistance type of thermo-electric pyrometer was developed in 1906.

(*To be continued.*)

Slide, Rotary, and Piston vs. Poppet Valves

By EUGENE P. BATZELL.

This paper was presented at the summer meeting of the Society of Automobile Engineers and is a resumé of the valve situation illustrating the various types in use and proposed, discussing in detail their respective merits. It is pointed out that poppet types of valves are difficult to maintain in noiseless condition and it is the claim of this author that questions of noise are at the bottom of much activity in favor of the elimination of the poppet type of valve.

DESPITE the seeming activity along lines involving other than poppet types of valves the author of this paper has pointed out that but few slide, rotary, and piston types of valves have found favor in practice. He goes on to say: "Still fewer have been subjected to tests. It is easily understood that the published test results of different silent valve motors all appear to be favorable; nevertheless, without gaining the favor of engineering circles and of the general public. The best proof of this is that only few of such valve systems are being built by others than those through whom they originated; and their comparative success is accountable largely to vigorous advertising campaigns. Probably some time will elapse before the silent valve systems will be used extensively, and compete successfully with poppet valves, because the latter are highly developed and reliable.

"On account of lack of dates and information upon the silent valve systems, it would be hard and of little value to discuss the practical lines of their construction. One would be compelled to guess, because the final word will be spoken after the motors have been in public use for a long time. There is, however, a possibility of investigating the subject theoretically, particularly as to motor power. Theoretically deduced results will have to undergo many corrections in practice.

"The discussion will be taken up here mostly as an investigation of valve-opening diagrams, together with their respective intake gas velocities. Let everything be referred to four-cycle single-cylinder motors of five-inch bore and six-inch stroke running at 1000 r.p.m., corresponding to a 1000 feet per minute piston speed. The cam-operated poppet valves only will be discussed, not touching the possibility of their being operated indirectly by some means.

"The rate and duration of opening of a poppet valve depend on the shape and size of the cam, and the type and size of the cam-follower. The most extensively used forms of cam-followers are the roller, the 'V'-shaped, and the flat or mushroom valve lifter foot. The valve-opening diagrams with the roller and the 'V'-shaped valve lifters depend upon the radii of the contact surfaces. Identical diagrams are obtained regardless of whether the cam-base circle or the follower-roller or spindle are made of a certain size, providing the relation between them remains the same. Therefore, only the flat and roller lifters will be considered.

"As to the cams themselves, they can be made in very different shapes. In Fig. 1 are represented three, which will be discussed here, 1 and 2 being designed for use with a roller-lifter and 3 for the flat. They are all inlet cams with same lift (five-six-teenths inch), and are shaped for the same duration of valve opening, namely, 210 degrees of crankshaft movement. The inlet could, for instance, start to open 5 degrees after the upper dead center, and close 35 degrees after the lower dead center, which is fairly good timing for high and medium speed. With roller-lifter cams there is a one-sixty-fourth-inch clearance between the valve stem and the lifter. The cam for the flat lifter is easier to shape with a greater clearance, which is made one-thirty-second inch on the drawing.

"The cam base circles are all 1 1-4 inches in diameter, and the roller is 7-8 inch in diameter. The flat contact surface of the valve lifter is one inch in diameter, and the cam is rounded in such a manner that contact with the edge of the lifter is avoided.

"The top portion of the cam is a single circle tangential to its straight flanks, which latter are determined by the position of the roller and the valve lifter clearance in the usual way; that is, the lines touching the roller and the cam-base circle at the moments when the inlet begins to open and close. The flanks of the cams are determined in the same manner, but the extremity of the cam is formed by an arc concentric with the base circle, and extended until it intersects the flanks. These intersections are rounded into a small radius. On the drawings, Fig. 1, the dotted lines 'b' represent the amount of valve lift. For each angular position of the cam the lift is equal to the distance between lines b and c taken in the direction of the center line of the valve-lifter. For cams 1 and 2 line c is a circle, passing through the center of the roller at the moment of valve opening, and for cam 3 it is the clearance circle.

"The valve lifts obtained in such a manner for different angles between the cam center and the lifter can be plotted against the angles of crank position, thus giving valve-opening diagrams. Such diagrams for the cams of Fig. 1 are reproduced in Fig. 2, and are indicated according to the cam numbers by 1, 2 and 3. They all give the following timing: Inlet opens at 5 degrees after the upper dead center and closes 35 degrees after the lower dead center. However, the area of valve opening at any particular crank position is a more important thing to know than the valve lift. Assuming that the gases flow through the valve opening parallel to the valve seat:

Let,

h = lift of valve in inches;

h_1 = distance between valve seat and face of valve in inches;

d = diameter of orifice below the valve seat in inches;

d_1 = outside diameter of conical valve in inches;

When,

$$S = \pi \times d_1 \times h_1 = \pi (d + h_1 \sin a)\, h_1$$

or substituting $h_1 = h \cos a$

$$S = \pi (d + h \sin a \cos a)\, h \cos a \ldots\ldots\ldots\ldots (1)$$

"When the valve seat is flat the area S is proportional to the valve lift h, as then the second part in the parentheses disappears. Flat valve seats are seldom used, however, because they are hard to keep tight; they retard rather than promote the gas flow, making the gas change its direction suddenly, and besides they also become beveled in time. For bevel-seated valves the port area S is a function of the second degree, according to equation (1). However, this area may be considered directly proportional to the valve lift h in this case also, because the squared factor in equation (1) is relatively small and may be neglected. The error thus made is the slighter the smaller the horizontal

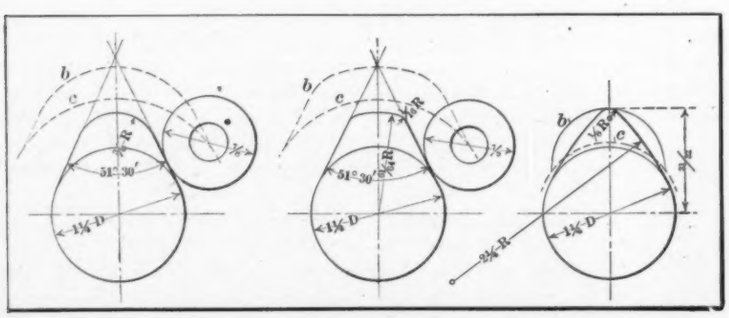


Fig. 1—Inlet cams, with 5-16-inch lift, shaped for 210 degrees opening; 1 and 2 for use with roller-lifter; 3 for flat

angle of the valve seat. Assuming, then, that the valve lift and port area are directly proportional, we may also consider curves 1, 2 and 3 of Fig. 2 as representing the variation of this port area with the crank position, and it is only necessary to construct a diagram of the proper scale to get the port opening areas in actual figures. We will suppose that the motors in question have valves of 2 7-16 inches clear diameter, and that the valve-seat has a 30-degree horizontal angle a. As the lift was made 5-16 inch, the maximum valve port area is:

$$S_{max} = \pi\,(2.4375 + .1355) \times .271 = 2.2 \text{ square inches.}$$

"If we make the valve lift of 5-16 inch in Fig. 2 correspond to 2.2 square inches, the scale for the port area curves becomes known, and it is then possible to draw from these diagrams a number of conclusions as to the motor characteristics with the different poppet-valve lifting mechanism.

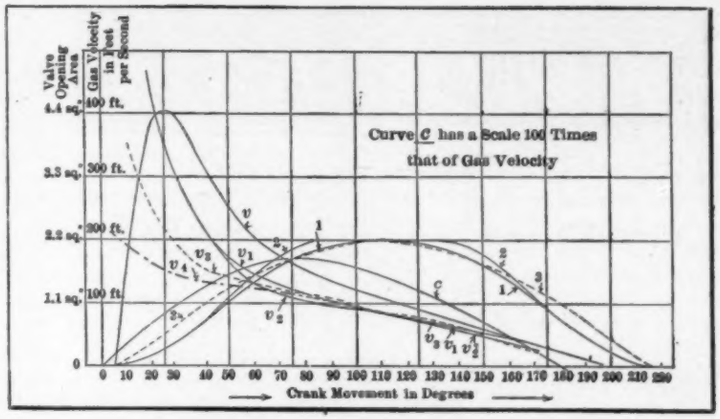

Valve Opening Area
Gas Velocity in Feet per Second
4.4 sq.
400 ft.
3.3 sq.
300 ft.
2.2 sq.
200 ft.
1.1 sq.
100 ft.
0
Curve C has a Scale 100 Times that of Gas Velocity
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Crank Movement in Degrees

Fig. 2—Valve-opening diagrams of cams shown in Fig. 1

"As may be seen from Fig. 2, the area enclosed by the curve 3 is slightly larger than that enclosed by curve 2, and these areas are both larger than the area enclosed by curve 1."

The author here introduced an equation involving the momentary valve port area in function of the crank position given by time, went on to state a method of arriving at gas velocity, and utilized the customary equation for piston speed, pointing out, however, that the same is not exact, and that the piston speeds may be found in the curve C, Fig. 2, assuming that the motor is traveling at 1,000 revolutions per minute. The paper deals next with the questions of motor power with different cams.

"Comparing these three curves in Fig. 2, we notice a maximum difference of about 10 per cent. between v_1 and v_2. Moreover, this difference occurs when the inlet openings are near their maximum, and when the gas velocity is much lower than at the beginning of the opening. Therefore, in respect to motor power cam 2 will show no great advantage over cam 1. (Fig. 1.) With slow-running motors, the difference between these cams may be absolutely imperceptible.

"With these cams under the assumed conditions, the inlet gases are strongly choked during the earlier part of the valve opening, and consequently there is considerable vacuum inside the cylinder during this period. This vacuum, besides causing direct loss of motor power, also sucks oil past the piston, which tends to cause carbonization. A point in favor of high intake velocity is a more complete vaporizing and mixing of the gas particles with the air when entering the cylinder. But normal gas velocities should be sufficient for that, so that any increase would be a pure loss.

"The theoretical gas velocity drops much more quickly with cam 3 than with cams 1 and 2, and consequently the intake gases are much less choked with this cam during the early part of the inlet. The difference in velocities with cam 3 and the roller cams, respectively, amounts to 20-30 per cent. during a crank motion of 45 degrees, and, furthermore, the choking effect is proportional to the second power of the gas velocity at least. The quantity of fresh charge admitted to the cylinder during the first half turn of the crank will be considerably greater with valve-lifting mechanism 3, and this will reduce the vacuum inside the cylinder, together with its bad results. This mechanism is decidedly advantageous, except that it requires very strong valve springs, because the first part of the curve of cam lift is very steep.

The stronger the valve springs are the more the valve seat and valve mechanism are subjected to wear, and constructions 2 and 3 are particularly disadvantageous because of the great sliding motion of the cam against the lifter. Of course, cams for roller lifters can be shaped to give the same quick opening as cam 3, but the objections to quick opening are then greater.

"With valves of the same weight and the same lift acceleration, the roller-lifter, being heavier than the flat one, requires stronger valve-closing springs. There is but little wear on the faces of cams and rollers due to the roller action, providing they are properly hardened and the springs are strong enough to keep them in contact. Therefore, the wear of them cannot be given here as an objection to strong springs, but the valves coming under action of the stronger springs, and with a quicker motion against their seats, cause more noise and become leaky more often, which is due to increased hammering into the seats of carbon particles.

"In curves v_1, v_2 and v_3 of Fig. 2 it will be noticed that the gas velocity also gradually drops during the period when the valve openings decrease, because of a more rapid decrease in the piston speed. From a velocity of 170 feet per second at the moment of greatest valve opening, the gas velocity drops to about 50 feet per second during the following 60 degrees of crank travel. At the lower dead center the inlet valves still have openings 0.7 square inch (cams 1 and 2) and 1 square inch (cam 3), respectively. The last 10 degrees of crank movement before the dead center need not materially influence the change of gas velocity, and during the following crank movement it cannot be greater than 50 feet per second, as it was at 170 degrees crank position.

(To be continued.)

Coming Events in the Automobiling World

Dec. 1.....Chicago, Ill., First Annual Aeronautical Exhibition in the Coliseum.

Jan. 7-14, 1911...New York City, Madison Square Garden, Eleventh Annual Show, Pleasure Car Division, Association of Licensed Automobile Manufacturers.

Jan. 16-21, 1911..New York City, Madison Square Garden, Eleventh Annual Show, Commercial Division, A. L. A. M.

Jan. 28-Feb. 4, '11.Chicago Coliseum, Tenth Annual National Automobile Show Under the Auspices of the National Association of Automobile Manufacturers, Inc., Pleasure Cars and Accessories, Exclusively.

Feb. 6-Feb. 11, '11.Chicago Coliseum, Tenth National National Automobile Show Under the Auspices of the National Association of Automobile Monufacturers, Inc., Commercial Vehicles, Pleasure Cars, Motorcycles and Accessories.

Races, Hill-Climbs, Etc.

Aug. 3-5.....Galveston, Tex., Beach Races, Galveston Automobile Club.
Aug. 6.....Point Breeze, Track Meet, Quaker City Motor Club, Philadelphia, Pa.
Aug. 16.....Start of Munsey Tour.
Aug. 23.....Cheyenne, Wyo., Track Meet.
Aug. 26-27.....Elgin, Ill., Road Race, Chicago Motor Club of Chicago, Ill.
Aug. 31.....Minnesota State Automobile Association's Reliability Run.
Aug. 31-Sept. 8..Kansas City, Mo., Reliability Run, Auto Club of Kansas City.
Sept. 2-5.....Indianapolis, Ind., Speedway Meet.
Sept. 3-5.....Run and Labor Day Race Meet of North Wildwood Automobile Club.
Sept. 7-10.....Buffalo, N. Y., Reliability Run, Auto Club of Buffalo.
Sept. 15.....Algonquin, Ill., Annual Hill Climb of Chicago Motor Club.

THE AUTOMOBILE

Vol. XXIII Thursday, August 4, 1910 No. 5

THE CLASS JOURNAL COMPANY

H. M. SWETLAND, President
A. B. SWETLAND, General Manager
231-241 West 39th Street, New York City

EDITORIAL DEPARTMENT

THOS. J. FAY, Managing Editor
GEORGE M. SCHELL
JAMES R. DOOLITTLE
W. F. BRADLEY, Foreign Representative

ADVERTISING DEPARTMENT

W. I. RALPH, 1035 Old South Bldg., Boston
C. H. GURNETT, F. W. VAN SICKLEN, 1200 Michigan Ave., Chicago
T. B. VAN ALSTYNE, New York and Phila.
H. L. SPOHN, New York
LOUIS R. SMITH, New York
FRANK B. BARNETT, 309 Park Building, Cleveland
H. H. GILL, 814 Majestic Building, Detroit

Cable Address - - - - - - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES

United States and Mexico - - - - - - - - - - - - - - One Year, $3 00
Other Countries in Postal Union, including Canada - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

FOREIGN SUBSCRIPTION AGENTS

ENGLAND:—W. H. Smith & Sons, Ltd., 186 Strand, London, W. C., and all bookstalls and agencies in Great Britain; also in Paris at 248 Rue de Rivoli.
FRANCE:—L. Baudry de Saunier, offices of "Omnia," 20 Rue Duret, Avenue de la Grande Armee, Paris.
GERMANY:—A. Seydel, Mohrenstrasse 9, Berlin.

Entered at New York, N. Y., as second-class matter.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907

"APACHES," among America's red men, represented the most unscrupulous and altogether bad Indians of the many tribes which infested the American continent, probably from the days of the mound-builders down to the time when the pressure of the white man produced extermination of all but a few degenerates who put in their time drinking fire-water and gambling.

* * *

QUOTING the New York *Herald* of August 2, this respected newspaper reminds us of the fact that the "Apaches," after having run the gamut in Arizona, took up their abode in Paris, where it was hoped they would remain under the enlightened guidance of the French. As the *Herald* states, "American financiers come in for virulent criticism in the reviews of the Bourse, which Paris newspapers publish at the end of the week. It has become a fashion here of late years to call all malefactors 'Apaches.' You will, therefore, understand the significance of the fact that, in commenting on the battle royal which big interests have been waging in Wall Street at the public's expense, French critics manifest a tendency to dub the leading spirits in it 'Financial Apaches.'"

* * *

ARE "Financial Apaches" trying to take the scalp of the automobile business?

AT the Summer meeting of the Society of Automobile Engineers just concluded, many points of interest were raised and discussed, and a close observer will have reached the conclusion that the attention of the body to some phases of the problem is timely.

* * *

GOOD steel is admitted to be a necessity, but the struggle for quality must await the coming of the time when automobile engineers may be permitted to know how to ask for what they want. For many years steel mills not only fabricated their wares, but they had time to expend in fabricating the literature of the day, to the confusion of their patrons, if not to the exclusion of quality product.

* * *

IF makers of steel were to succeed in packing the conventions, overawing engineers by their presence and a flood of questionable information, they would succeed in perpetuating the literature that has been fastened upon the industry, fostered by those whose interest lies in finding a willing purchaser, made the more so by being drugged to insensibility by statements that may be twisted and distorted until they mean anything that the victim's master dictates.

* * *

PLAINLY speaking, the good that any society can do depends upon the intelligence displayed by its management. The body politic is taught to abide by the decision of its accepted leaders, and to believe that they are acting in the best interests of all concerned. In the case of the Society of Automobile Engineers, should the leaders be swayed by a clique of steel men the body politic would find itself steeped in the dye of poor material, and the makers of foreign automobiles would be free to bid for the better class of trade.

* * *

IT is frequently claimed that foreign automobiles are superior because the material used in them is better than that obtained elsewhere. American makers of automobiles stoutly contend to the contrary, and it is one of the high aims of automobile engineers to justify this contention. In glancing over a daily paper of recent vintage, one of the items read substantially as follows: "The company just placed the largest order for cold-rolled steel that was ever given by any automobile company." If this statement was true, it is highly improbable that this company had any room in its product for anything but cold-rolled steel.

* * *

SPECIFICATIONS are about to be formulated under the auspices of the Society of Automobile Engineers, and a committee on standards is to be given charge of the work. That this committee should be made up of the agents of steel mills is not to be expected, but that the agents of steel mills would like to control the committee is a natural inference.

* * *

AGENTS of steel mills may be divided into two classes: the first admits it, but the second denies the soft impeachment.

Detroit Extends Welcome to the Largest S.A.E. Gathering

(*Continued from page 178*)

Gears Quiet by Grinding." Every automobile engineer appreciates the importance of this question; it is fully understood that gears have to be hard to serve well, and it is remembered that warping is a normal expectation in the hardening process. The gear grinder described by Mr. Ward takes the gears after they are hardened and refashions the teeth so that they conform to the involute with a 14 1-2 degree face angle. Mr. Ward, in response to query, stated that he had a preference for 6 diametral pitch gears and that an allowance of ten thousandths of an inch should be made for grinding, thus demanding the use of gashing cutters suitably sized to afford this allowance. Perhaps one of the most important details brought out in the discussion is represented in the fact that the depth of grinding will not be the same at all points in the diameter, so that the thickness of the case grown in the cementing process must always be sufficient to take care of the eccentricity. There seems to be no way of avoiding this difficulty and it stands to reason that unless the depth of the case is greater than under ordinary conditions there is an excellent chance of realizing "thin ice" at some point in the diameter, due to the grinding process. Quite a number of the members present failed to agree with Mr. Ward when he said that the gear grinders referred to were not to be sold outright by the makers, but that they preferred to do the grinding work for builders of automobiles, claiming that the cost is but slightly increased, all things considered, and that deliveries will undoubtedly be prompt. One member, however, made a rough calculation and was curious to know what might be expected if a company building 30,000 automobiles per annum, with upward of 300,000 gears to be hardened and ground, was to dump them at the door of the gear grinding establishment and ask for a prompt delivery. This one member may not have taken into account the fact that there are a large number of companies in this country, and that more than one of them would be in a postion to order 300,000 gears per annum.

The problem of standardization was given a boost in the right direction by D. F. Graham in his paper entitled "The Variation of Current Practice in Anti-friction Bearings." Mr. Graham's effort has the earmarks of a painstaking research, and in tabular form affords a wide variety of definite information bearing upon present practice. To what extent this effort will further the process of standardization remains to be seen. It is understood that there will be a committee appointed to deal with the process involved, and it is recognized that the committee will scarcely be able to deliberate at once upon all the subjects.

Lawrence W. Whitcomb presented a most comprehensive paper bearing upon the economical side of shop unkeep, having for its basis the elimination of power losses through the use of "cork inserts" in pulleys for the purpose of reducing slippage. It is well understood that there is a considerable loss of power during its transmission by belts running over pulleys and for many years millwrights struggled with the problem unsuccessfully. Cork inserts seem to be efficacious, due to the high coefficient of friction of cork, and to the peculiar fact that this coefficient is not materially reduced by lubricating oil. The paper affords a wide range of exact information and carried conviction sufficiently to abort discussion.

The paper by H. H. Brown, entitled "The Carrying of Tools, Spare Tires and Supplies," was the only one which recognized the necessities of the supporters of the industry in the form of users of automobiles, and while it deals tersely with some nice phases of the situation, it is nevertheless an inadequate tribute to be paid to the American citizens who have made the automobile industry possible. That President Coffin ultimately expects to lead the way to the direct benefits due to purchasers of automobiles, before the campaign is terminated, is quite well appreciated by those who have given the matter more than passing attention. President Coffin, in his opening address, discussed the lines along which the organization may be made of the greatest value to its members individually, and to the motor car industry. He made it clear to an attentive audience that standardization must begin at the bottom and work up. Every piece that enters into a car must be made of standardized material from designs by standard formulæ, and so processed that it will have the benefit of standard methods of heat treatment and other devices in finishing.

As a direct result of efforts at standardization, L. R. Smith, of the A. O. Smith Company, presented a large number of examples of side frames, cross bars, and other parts as used regularly in automobile work, giving chemical analysis and physical properties of the materials used, offering suggestions as to the methods to employ in designing, and pointing out how the best results will be obtained at the lowest cost of manufacture without in any way interfering with the original ideas of the designer who wishes to impress the imprint of his originality onto the cars of his design. Mr. Smith's splendid work was conspicuously supported by efforts on the part of the makers of steel tubing, who pointed out in a substantial way how it is possible to save cost, and arrive at a fitting conclusion by a no more difficult process than the mere selection of the sizes of tubing that are regularly made, rather than to create new sizes, which is frequently done in the drawing office in the absence of a table of standards to go by.

The whole situation, as one of the results of this meeting of the Society, will end in the appointing of a committee on standards, the same to be composed of 10 capable members, and to be subdivided sufficiently to bring about rapid conclusions, with the expectation that within a relatively short period of time the materials best to employ in automobile work will be given the mark of approval of the committee, and the standards so made, after being accepted by the Society as a whole, will be available to the makers of automobiles. It is undoubtedly true that the supporters of the industry, while they will find this process less spectacular than some other undertakings, will nevertheless observe that it will prove to be of the greatest benefit, ending in a lower cost of maintenance of the cars, if indeed the first cost may not be favorably affected as well.

Perhaps the most interesting paper from the engineer's point of view was that by Professor Bristol on pyrometers. The discussion of this paper will be given in full at the end of the same when it appears in THE AUTOMOBILE, but to indicate something of the value of the paper a portion of the discussion will be quoted here: "One thing he has not brought out is that in using a pyrometer there must be a great deal of common sense put into the use of it. For example, we have seen some pyrometers so installed that the heat junction, that is, the top of the pyrometer, was up by the brickwork, and the people could not understand when the furnace was red enough to anneal steel it did not show more than 800 or 900 deg. F. or something of that kind, and the reverse; they have put it in the hottest part of the furnace, perhaps over the bridge wall, where the flames pass over it continually, and the thermometer cannot by any possibility give the true temperature of work that is on the hearth of the furnace; so that is the reason we say that a whole lot of common sense must be used, and we think one of these arrangements as indicated is a good one."

Mr. Alden raised another question that proved to be of interest: "Will the Bristol pyrometer show more than one of the two or three critical points?" Mr. Bristol answered: "It will only show the first point." Just how nicely the first point was brought out by the Bristol instrument was a subject for demonstration, and many of the members expressed great satisfaction at what they observed.

Eighteen Perfect Scores in Cleveland Reliability

CLEVELAND, Aug. 1—Eighteen automobiles out of a total of 30 which made the three-day reliability tour under the auspices of the Cleveland News and the Cleveland Automobile Club, finished the run Wednesday night with a perfect score.

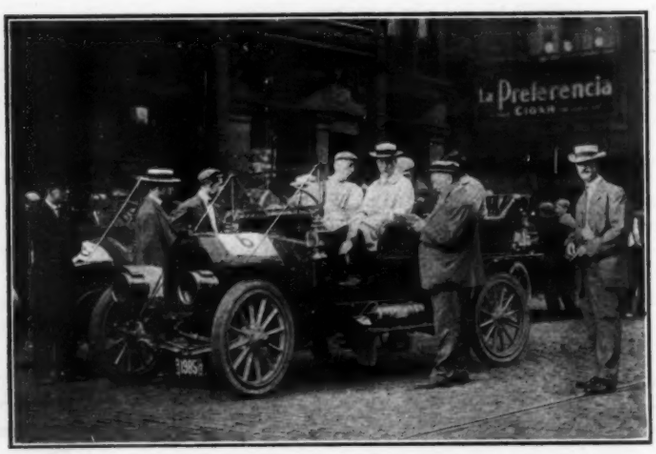
A drenching rain caught the party when it was a few miles out of the city, but had no effect on its enthusiasm. The motorists, traveled-stained and weary, formed into line, and with an escorting party of 50 automobile enthusiasts and a band at their head, paraded to the Hollenden hotel. On Friday night the party again met at the Hollenden to receive the announcement of scores and awards.

Besides the trophy cups awarded by the *News*, a trophy in the 1A class for cars selling under $800 was awarded to the Hupmobile driven by John Rauch. To H. C. Knudsen, who maintained a perfect score with his Overland, was awarded a Goodyear air bottle. John Stambaugh, in a Chalmers "30," was awarded a road map. The penalties incurred by the other contestants were, with only one or two exceptions, due to minor difficulties.

The first day's run ended in Columbus, O. The country was rich in natural beauty, but parched for want of rain, making the dust heavy and the going hard. The big Peerless with its $3,000 Gabriel organ, the Thomas flyer, the Oldsmobile Mudlark, the Chalmers and the 2-ton Garford truck attracted attention along the whole route.

The start on the second day was made at 6:30 in the morning. The route was from Columbus, via Lima, Findlay, Bowling Green to Toledo. The roads were good and there were few hills. Tire trouble was the severest affliction of the day's run. A number of cars were delayed on account of such trouble for much of which the excessive heat could be blamed. Residents along the route tossed apples and other fruits to the motorists as they hastened by.

A heavy thunderstorm during the night at Toledo cooled the air, laid the dust and made the last day's run the most comfortable of the three. As the route led nearer home the size of the welcoming parties in the various towns became larger and larger. At Norwalk where luncheon was had the mayor and other city officials were on hand to greet the party. The street in front of the hotel was blocked for nearly an hour while the crowd eagerly examined the machines. Between Norwalk and Elyria the cars were given their final test for sturdiness. The rain of the night before had filled the holes and ruts with mud and water which made it impossible to gauge the road. The big Studebaker "40," the pathfinder, blew a tire and the confetti was transferred to the following car, a White gasoline car driven by Willie Stutsen, A. A. A. representative.



The E-M-F was among the clean-score cars

The contestants pulled into Cleveland about 6 o'clock. The summary:

No.	Car	Driver	Score
1	Oldsmobile	J. C. Winters	1000
3	Studebaker "40"	Ira Fouche	1000
4	Palmer-Singer	Hugh Miller	1000
6	E. M. F.	Frank Grace	1000
7	Henry "35"	J. B. Sperry	1000
8	Regal	J. C. Hipp	1000
10	Gabriel	A. L. Soper	1000
11	Firestone-Columbus	H. McIntosh	1000
17	Cutting "40"	J. C. Koepke	1000
18	Maxwell	Frank Santry	1000
20	Columbia	C. G. Bleasdale	1000
22	Gaeth	O. Lindner	1000
25	Owen	F. Munroe	1000
27	Garford Truck	Ralph Kinney	1000
33	Oakland "24"	Fred Krum	1000
35	Overland	H. C. Knudsen	1000
36	Chalmers "30"	J. Stambaugh II	1000
39	Hudson	William McCalla	1000
34	Stoddard-Dayton	H. S. Moore	997
16	Hupmobile	John Rauch	990
12	Atlas	Harry Kortz	992
31	Hines Car	F. J. Moore	983
15	Pierce Racine	C. N. White	978
24	Krit	H. Gabriel	976
32	Norwalk "35"	H. B. Olds	967
30	Packard	F. J. Lentz	939
19	Brush	D. E. McCoy	930
28	De Tamble	W. W. Orndorfer	841
9	Hines Car	O. Alexander	805
26	National	D. E. Foote	

Owen, No. 25, also finished without a demerit

Franklin Wins "Little" Glidden Trophy

MINNEAPOLIS, MINN., July 30—Scores of the second annual tour of the Minnesota State Automobile Association were announced late to-day by Dr. C. E. Dutton, the referee. The high score was made by the Franklin, a St. Paul car, which carries with it the *Dispatch* trophy for the Automobile Club of St. Paul. The winner belongs to W. H. Kent.

The Werner prize was also taken by the Franklin. The Gregg trophy for small cars goes to either the Ford or the Reo, according to the maximum price set for the division line of small cars. The two winning drivers get gold medals, and Renville county is awarded the Louis W. Hill good roads prize. Summary:

No.	Name	Driver	Score
1	Pierce	Succow, Phillips	952
3	Hup	E. B. Stimson	896
4	Roe	G. A. Lewis	989
5	Staver-Chicago	Troy Duis	450
6	Hal'aday	O. A. Palmund	957
7	Cadillac	Rud Stensvad	957½
8	Auburn	W. J. Ranger	851
9	Regal	Arthur La Roche	704
10	Cole "30"	F. J. Seifert	884
11	Cole "30"	W. A. Alden	947
12	Ford	A. A. Hanson	979
13	Franklin	A. H. Clark	997
14	Hudson	O. E. Martin	936
15	Halladay	C. W. Shanno	899
16	Glide	B. E. Sylvester	268
17	Chalmers	J. S. Gilbert	943
18	Carter Car	R. H. Ivey	897

Atlanta's Local Speedway Meet a Big Success

ATLANTA, July 30—Despite postponement of a week, the meeting held to-day on the Speedway proved a success from every point of view. The program consisted of eleven races, six of which were according to piston displacement classes; three were free-for-all; one a pursuit race and the other a match.

The Flanders, Firestone-Columbus, National and Pope-Hartford entries won a majority of the events. The Fiat and Simplex divided the two free-for-all dash races, but the Firestone-Columbus won the open handicap.

The prettiest finish of the day was in the eighth race at 8 miles, when the E-M-F. won from the Firestone-Columbus by inches after being defeated by the same car in a preceding race.

The Fiat 60 belonging to Asa Candler, Jr., had a narrow escape from destruction when the steering arm broke and the front wheel buckled while making about 70 miles an hour in the second free-for-all. The summary:

Two mile time trials—

Car	H.P.	Entrant	Driver	Time
Fiat	60	Asa Candler, Jr.	W. J. Stoddard	1:34 3-5
Simplex	50	E. H. Inman	R. Church	1:37 3-5
Buick	30	W. E. Wimpy	E. W. Smith	1:55 4-5
Cadillac	30	A. Lemon	A. Lemon	2:07 3-5

Columbia, No. 20, one of the Cleveland "immaculates"

For 160 cubic inches and under, six miles—

Flanders	20	G. W. Hanson	H. A. Witt	6:38 3-5
Benz	18	G. W. Hanson	H. Cohen	
Hupmobile	20	E. D. Crane	H. H. Hall	

Match race, ten miles—

National	40	W. J. Stoddard	W. J. Stoddard	8:39
Renault	35	Asa Candler, Jr.	J. Woodside	

For 231 to 300 cubic inches displacement, twelve miles—

Pope-Hartford	25	F. Steinhauer	R. Church	11:53 4-5
Maxwell	30	Max.-Bris. S. Co.	J. Roach	
Maxwell	30	Max.-Bris. S. Co.	M. LaHatte	

160 cubic inches and under, ten miles—

Flanders	20	G. W. Hanson	H. A. Witt	9:20
Hupmobile	20	E. D. Crane	H. H. Hall	
Fiat	12	J. M. Nye	J. Taylor	

161 to 230 cubic inches, ten miles—

Firestone	30	E. D. Crane	McKinstry	8:35
E-M-F	30	R. W. Hanson	Cohen	
Maxwell	22	Max-Bris S. Co.	Rambo	

Free-for-all, ten miles—

Fiat	60	Asa Candler, Jr.	W. J. Stoddard	8:03 3-5
Simplex	50	E. H Inman	R. Church	
Renault	35	Asa Candler, Jr.	J. Woodside	

Australian pursuit race—

Renault won from Buick and S. P. O., Time 11:11.

161-230 class, eight miles—

E-M-F	30	R. W. Hanson	Cohen	7:34 3-5
Firestone-Columbus	30	E. D. Crane	McKinstry	
Oakland	30	J. L. Wright	Moss	

Free-for-all, ten miles—

Simplex	50	E. H. Inman	R. Church	8:16 3-5
Renault	35	Asa Candler, Jr.	J. Woodside	
S. P. O.	38	W. Candler	Toole	

231-300 cubic inches class, twelve miles—

Pope-Hartford	25	F. Steinhauer	R. Church	12:33 1-5
Parry	32	R. C. Howard	B. T. Phillips	

301-450 cubic inches class, twelve miles—

Car	H.P.	Entrant	Driver	Time
S. P. O.	38	W. Candler	Toole	12:38 2-5

Free-for-all, ten miles, handicap—

Firestone-Columbus	30	E. D. Crane	McKinstry	11.
Maxwell	22	Max.-Bris. S. Co.	Rambo	
Renault	35	Asa Candler, Jr.	Woodside	

Bad Roads Cost Farmers $225,000,000 in 1909

NIAGARA FALLS, July 30—The Third Annual Good Roads Congress adjourned to-day after three days of deliberation which were filled with consideration of projects that are of the utmost importance to the citizens of the United States and other American countries. The convention was not as well attended as had been hoped, but nevertheless it drew out a representative gathering of men high in business, finance and professional life. One of the most striking of the addresses was that of B. F. Yoakum, chairman of the Board of Directors of the 'Frisco System.

The gist of his speech was contained in the following remarkable statement:

"On the basis of the government's estimate of the present excess cost of fifteen cents a ton for hauling in this country as compared with European countries, improved roads would have meant to the farmers on last year's crop an additional $225,000,000, thus increasing their $8,750,000,000 crop to $10,000,000,000.

"Every detailed analysis of the government's business methods proves them to be wasteful. One of the ablest United States Senators recently announced that the government could be run for $300,000,000 annually less than it is now costing.

"I can say as emphatically that $300,000,000 annually will give to this country 100,000 miles of improved public highways a year.

"If you take up your work of better roads, to be paid for through a reduction of governmental waste, your work will be effective and for the general good of all."

The second day of the conference was devoted in large part to the needs of the South and Southwest. J. Hampton Rich and John Crafts of Alabama were the chief speakers.

The final day was given up in part to the consideration of a plan to build a great boulevard from New York to Niagara Falls. The other important work of the session was the action taken to secure federal co-operation in the matter of building roads.

The chief speakers of the convention aside from those named above were: Arthur C. Jackson, president of the association; Mayor Douglass of Buffalo; Congressman William F. Sulzer; Charles B. Matthews; the Mayors of St. Catherine and Guelph, J. A. Pennypacker, Jr., George A. Colley; former U. S. Senator Dodge of Ohio; A. G. Spalding and James L. Cowles.

The next important good roads meeting will be held at Oklahoma City, October 4 to 6.

Palmer--Singer, No. 4, was also unpenalized in Cleveland run

News Happenings of the Week in Detroit

DETROIT, MICH., July 31—The awarding of the Glidden trophy is not the only thing to cause the Chalmers Motor Company satisfaction, however. At a meeting of the company, last Tuesday, a cash dividend of 30 per cent. on the $300,000 capital stock of that concern, and a 900 per cent. stock declaration was made as a result of last year's operations. The stock dividend is represented by an increase in value of shares from $10 to $100, and the boosting of the capitalization from $300,000 to $3,000,000.

None of this increase is to go on the market, it being distributed pro rata among the present stockholders. Two years ago the Chalmers plant was comparatively insignificant. Since then it has been developed into an institution of the first magnitude, more than $1,500,000 have been invested in new buildings and machinery which turns out practically the entire car.

Considerable discussion has been indulged in locally because after purchasing a large tract of land in Detroit, the General Motors Company failed to begin operations on the immense plant it was promised would be located here. On the authority of John H. Johnson, president of the Peninsular Savings Bank, and closely identified with General Motors affairs, active building operations will begin as soon as track arrangements and some other details have been completed. Mr. Johnson also stamps as unfounded the rumor persistently circulated in local automobile circles that the Buick plant would be removed from Flint to this city.

The Aetna Investment Company, organized some time ago for the purpose of building a five-passenger touring car, has progressed to a point where it feels justified in increasing its capital stock from $5,000 to $20,000, this action having just been taken.

To date the State treasury has been enriched more than $51,000 by the sale of automobile and motorcycle licenses, something over 16,000 of the former and 867 of the latter having been issued. In addition orders have been placed for 23,000 tags to be delivered before Jan. 1 next.

The good roads sentiment worked up in Detroit and which promised to bear immediate fruit, must be nursed for a time yet because of legal obstacles in the way of securing an immediate submission of the question of a $2,000,000 bond issue for the purpose. The Board of Commerce had planned on having the question of bonding decided at once, but the law limits the county supervisors to two special meetings a year. These have been held, and the bond proposition will have to wait until the regular election in November, at which time it will be submitted to the voters.

Carload of Franklin branch managers and salesmen gathered at the Syracuse factory for the annual conference

The Grabowsky Power Wagon Company is preparing to move into the immense reinforced concrete plant it built at Mt. Elliott avenue and the Michigan Central Belt Line Railroad.

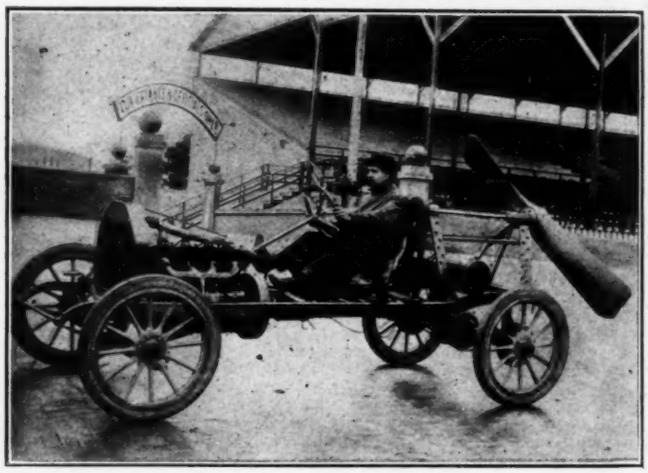
The Warren Motor Car Company has the first unit in its new plant well under construction; the Regal Motor Car Company will soon be able to occupy the great factory it is building on Piquette and Harper avenues, and the Metzger Motor Company is ready to break ground for its truck plant in the northern part of the city.

From Alpena comes the announcement that "Alpena Flyers," being manufactured there by the Alpena Motor Car Company, will make their appearance some time during August.

The Aero Club of Michigan has just had built for its use Michigan No. 1, a balloon of 45,000 cubic feet capacity.

The Cadillac Company plans to put out 12,000 cars for 1911. It has received from agents advance payments on 8,000 of these and the remaining 4,000 are also spoken for, although no advance payments have been made on them. Earlier in the year the Cadillac had some very pretentious building operations under contemplation. While all of the additions and new structures projected will be erected ultimately, only one of them will be built this year. This, with the old street-car barns recently acquired, will give the company all the additional facilities required for the immediate future, and will be in conformity with the conservative policy that has been followed by the Cadillac Company from the outset.

Frank Briscoe, chairman of the executive committee in charge of the Detroit division of the United States Motor Company, and



Overland "Wind Wagon," a cross between automobile and aeroplane, which covered five miles in 5:20

president of the Brush Runabout Company, pointed to the extensive building operations the United States Motor Company now has under way in Detroit, as showing its confidence in the future of the industry as far as its own operations are concerned.

"The Brush Runabout Company is just completing its 1910 output," he said. "We are preparing to turn out at least 15,000 cars next season, and by Jan. 1 we may decide to increase the number to 20,000. The past season's business brought a satisfactory profit, which, we expect, will be trebled next season.

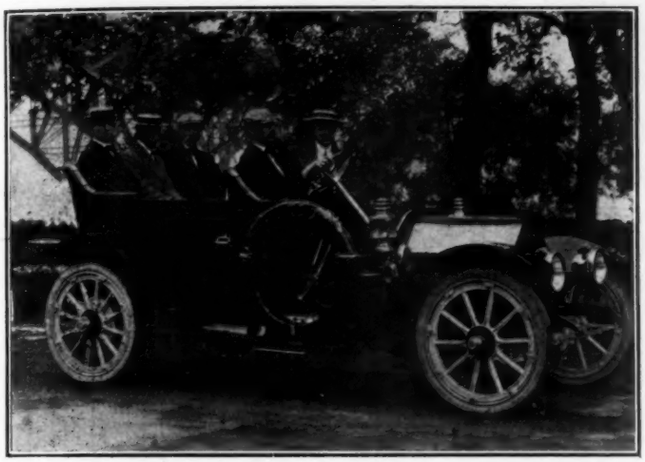
"The Briscoe Manufacturing Company has cut out its night work, but is running practically as strong a day shift as ever. Its sales of parts, exclusive of the Brush Runabout business, have amounted to $1,300,000 for the past year, and we expect they will be about $2,000,000 for the coming year. We have plenty of orders in hand and have had hold-ups but no cancellations.

"None of the constituent companies of the United States Motor

Company has had difficulty in disposing of its product, and each anticipates an increased production of cars the coming season.

"As to the general situation, I doubt if there is a concern, provided it is properly organized and managed, that is not as strong financially as any company of the same capitalization in any other line. There is, however, a general feeling of conservatism through the trade, and some of the wild plans for increase have been abandoned or modified."

Work on the Detroit factory of the Alden Sampson Company is progressing rapidly. The foundations are laid, the footings are in, and the entire building, measuring 150 x 1050 feet, will be completed by Sept. 15. The contract for the administration building was let during the past week. This will be 55 x 75 feet, two stories high, with outer walls of white pressed brick. General Manager Morris Grabowsky plans to start moving



The first Bergdoll "30" turned out of the factory—Vice-president E. C. Johnson at wheel, Technical Manager Willie Haupt beside him

into the main building as soon as the first 400 feet are completed, which will be about Aug. 10.

The Hale Motor Machinery Company has purchased a factory site, 196 x 200 feet, on Franklin street, between Joseph Campau avenue and Chene street, and will build at once. The price paid for the land was $14,000.

The manufacturers of the Houpt-Rockwell high-power cars are planning to invade the Michigan field, and have engaged Stanley F. Bates & Co. as their Michigan distributors. It is planned to establish a garage and salesroom in Detroit, and a full line will be carried.

The Steely Auto Engine Company filed articles of incorporation with the Secretary of State last week. The company is capitalized at $150,000, and the principal stockholders are Michael G. Delowey and Charles M. Steely.

Owing to largely increased business in this territory the Ohio Seamless Tube Company, of Shelby, O., manufacturers of cold-drawn seamless tubing, have opened a selling office in this city at 913 Ford Building, with Lloyd Brown in charge.

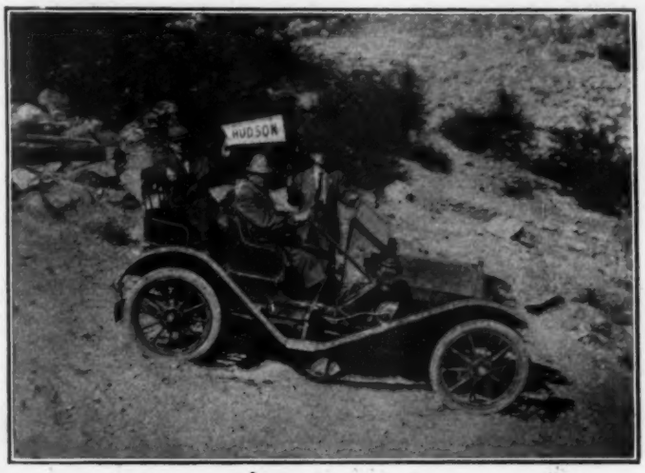
General Manager Fred W. Haines and Sales Manager George Wilcox, of the Regal Motor Car Company, have returned from a tour of the Regal branches in the West. They report that they found conditions in that section most satisfactory.

"Bobbie" Davis, manager for the Maxwell-Briscoe-McLeod Company, is taking a well-earned rest. Between selling cars and looking after the details of the recent auto parade, Mr. Davis was just about "all in" at the close of the Elks' reunion. He has gone to Buffalo with his wife and daughter.

J. M. Deuenas, a Chalmers dealer in Havana, is in the city arranging for his allotment of 1911 cars. Automobiles are growing constantly in favor in Cuba, he says. He reports an excellent trade in Chalmers cars for the past season.

"Automobile Day" at the Michigan State Fair, Sept. 24, will be enlivened by some interesting speed contests.

That the Elks' reunion is bringing results as far as local car



Hudson car which recently made 141-mile non-stop run to Mount Tacoma

dealers are concerned is already apparent. Dr. C. S. Kramer, past exalted ruler of the Pueblo, Col., lodge of Elks, who was a delegate to the convention, is driving home in a Cole "30," purchased from the local agency.

Stoddard-Dayton Wins Salt Lake Free-for-All

SALT LAKE CITY, UTAH, Aug. 1—The *Evening Telegram's* third annual hill-climbing contest held Saturday afternoon was by far the most successful event of its kind ever held in this section of the country. There were forty-two entries. The course was up what is known as Brigham street and was one mile in length, with a good grade all the way and with a sharp turn at the last quarter. There was one dispute. Samuel Newhouse, who gave the $1,000 trophy in the free-for-all, protested against the award of the cup to the Sharman Automobile Co., which entered both the Apperson and the Stoddard-Dayton. Newhouse contends that Driver Frank Seifert held back the Apperson in order that the Stoddard might win. A Thomas made an exhibition run up the hill in :56 2-5. The summary:

$800 class—Won by Hupmobile in 2:26 4-5.
$1,200 class—Won by Ford; time, 1:48 2-5. Buick 10, second; time, 1:51.
$1,300 class—Won by Stoddard-Dayton; time, 1:45 2-5. E-M-F second; Overland, third; Buick, fourth; Cadillac, fifth.
$3,000 class—Won by Stoddard-Dayton; time, 1:11 2-5. Buick, second; Winton, third; Premier, fourth; Buick, fifth.
$4,000 class—Won by Apperson; time, 1:05. Stoddard-Dayton, second; Thomas 40, third; Palmer-Singer, fourth; Buick, fifth; Premier, sixth.
$2,000 class—Buick and Velie tied for first; time, 1:25. Stoddard-Dayton, third; Buick, fourth; Overland, fifth.
Free-for-all—Won by Stoddard-Dayton; time, 1:08 3-5. Palmer-Singer, second; time, 1:11 2-5. Apperson, third; time, 1:12 2-5. Premier, fourth; Buick, fifth; Thomas Flyer, sixth; Packard, seventh; Velie, eighth; American, ninth; Studebaker, tenth.

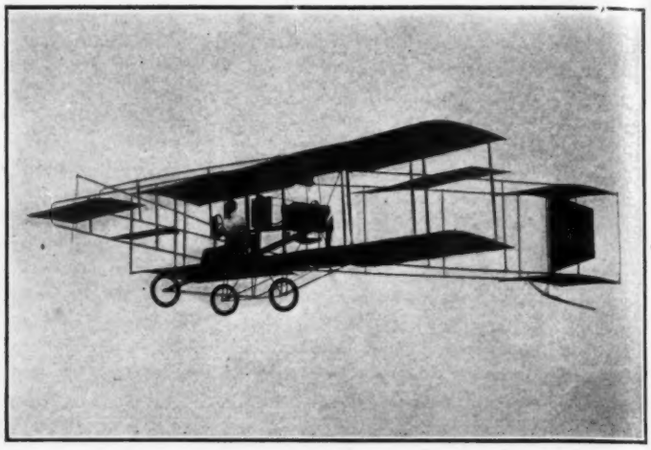
Aeroplane Propulsion Copied on a Land Car

The Overland "Wind Wagon," with Carl Baumhofer and Cleve Jeffries as pilots, which is now touring the Southwest giving a series of exhibitions, is an automobile driven entirely by an eight-foot wooden propeller in the rear. The machine created quite a sensation at the recent Indianapolis Speedway meet, where it negotiated five miles in five minutes and 20 seconds.

The Bergdoll "30" Makes Its Initial Bow

The new Bergdoll "30," product of the Louis J. Bergdoll Motor Company of Philadelphia, is about to make its advent. In fact, a few of the cars have been finished and many are in the final stages of manufacture. The factory was instituted less than a year ago at Thirty-first and Dauphin streets, and more recently the plant has been augmented by the acquisition of a building at Sixteenth and Callowhill streets, thus giving a floor space of 200,000 square feet. The officers of the company are: Louis J. Bergdoll, president; E. C. Johnson, vice-president; P. S. Malickson, secretary, and Charles A. Bergdoll, treasurer.

"Bleacherites" watching the races at Hempstead Plains



Captain Baldwin trying out his bi-plane

Aviation News of the Week

AVIATION from the viewpoint of the Summer visitor is one of the chief attractions of many of the resorts located near the metropolis. In a dozen different places, the air machines are busy every favorable day and the flights attract an immense amount of attention from the public.

Garden City, Narragansett Pier, Asbury Park, Atlantic City and a number of other places are the scenes of daily flights by professionals or amateurs. The newest thing in aircraft shown at these resorts is the French dirigible "Zodiac IV."

This ship, which is the smallest of the French dirigibles built so far, is owned by Stuart Davis of Scarborough, who has been studying aviation in France for the past six years. The vessel will be used as a pleasure craft and its official trial trip is scheduled for August 10. The gas bag is 109 feet long and the ship will carry four passengers.

Charles K. Hamilton, one of the earliest entrants for the $30,000 prize for flight between St. Louis and New York, has outlined his plans for the trial. He says he will start from St. Louis and prefers to make his official attempt for the big prize during the Indian Summer. A special bi-plane is in course of construction for Mr. Hamilton, which will include the most thoroughly tested features of that type of aircraft and will be equipped with wires having a tensile strength of 2300 pounds.

In speaking of the trip, Hamilton said: "I shall try to accomplish the flight as quickly as possible. There is no reason why an aeroplane should not fly ten hours a day and there is really nothing to prevent night flights. While I shall have to have gasoline and oil stations at a number of places, I shall carry an extra propeller and tools on board so as to be able to make repairs if forced to alight in out-of-the-way places, as I was in my return trip from Philadelphia."

The military significance of the recent aeroplane tests in the United States have found a resounding echo in foreign countries. While no public tests have been made, as far as is known, the results of the feat of Curtiss in America have caused an immense amount of conjecture and speculation. A leading official of the French Ministry of Marine in discussing the situation said: "Of course all that has been done in America could be duplicated here and the actual accomplishment in the United States is not in the least surprising to us. We have long accepted that fact as self-evident. The real question involved is as to whether the aeroplane could drop the bombs with the same accuracy under war conditions.

"Doubtless, should war break out to-morrow, the aeroplane would find use in the army and navy in an experimental way. This use would be vastly expanded by the development of reliability under adverse conditions."

Twenty French army officers have obtained licenses to pilot aeroplanes.

In speaking of the American war tests, Santos-Dumont said: "Any one who has flown knows it is very easy to drop an object from an aeroplane so as to hit a selected spot. Absolute accuracy depends only on practice."

Santos-Dumont hopes that the advent of the aeroplane in the field of war will make that practice so horrible that mankind will turn from bloody conflict to universal peace.

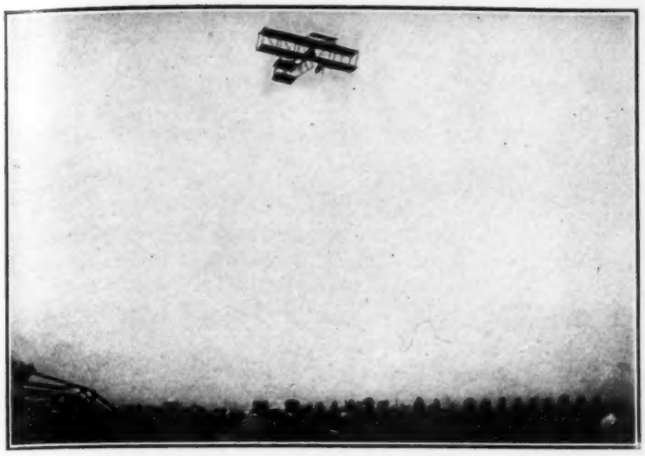
Count Jacques De Lesseps has returned to France. Before sailing he expressed the wish that he might be able to enter the international aviation meet on Long Island in October.

The Harvard Aeronautical Society has purchased a tri-plane from a British manufacturer and the machine will be used in the series of military tests on Soldiers' Field in September. The plans for these tests include a trial of accuracy in dropping bombs within the outline of a battleship. A prize of $5,000 has been offered.

Mrs. Russell Sage, widow of the former Wall street multimillionaire, witnessed the flights at Garden City, L. I., last week and after seeing a number of exhibitions exclaimed that she had caught the fever and stood ready to back any woman inventor of aircraft to demonstrate the feasibility of her ideas.

Alan R. Hawley, former vice-president of the Aero Club of America, has suggested a new use of the aeroplane. Mr. Hawley says that there is nothing to prevent aircraft from lending ma-

J. A. Drexel, of Philadelphia, ready for a start at Bournemouth



Harmon's bi-plane doing 50 miles an hour

The grand stand at Hempstead Plains is always well filled

terial aid to stranded ships by carrying lines to them from shore. He and several others interested in aeronautics are now arranging for the construction of a number of aero landings along the New England coast.

Clifford B. Harmon, the amateur flyer, has declined to make any further flights at Garden City if admission fees are charged. Big crowds have been attending the trials and Mr. Harmon's action was taken after he said he was certain that the gate receipts had been sufficient to defray the expense of the management in fitting the field for aviation.

The attempt at crossing the Atlantic ocean in a dirigible is taking something like definite form. The airship, "Amerika" is due to arrive Wednesday on the steamer Oceanic from Paris and will be set up at Atlantic City at once. Melvin Vaniman, aviator and mechanical engineer, is already here and says that on or about August 20 the start will be made. He says he expects to land in England in four or five days. Walter Wellman and five others are slated to man the "Amerika" on the voyage.

In the recent aero tournament at Bournemouth, England, Morane, pilot of a Blériot racer, won the first prize of $4,000 by a flight encircling the Needles. Armstrong Drexel, of Philadelphia, was second, also in a Blériot, and was awarded $2,000 and Grahame White, third, in a Farman bi-plane, receiving $500.

This competition, while in no sense a racing spectacle, proved exciting enough to receive much enthusiastic attention. But the event that was on the program as the star number was never called.

It was a proposed race between motor boat and aeroplane and the leading entrants in both divisions suffered mishaps before the event, that caused the officials of the meeting to call it off.

The arrangements for the race were made as the result of a challenge from the Motor Yacht Club to the Royal Aero Club for a suitable trophy. On the part of the yacht club, the Duke of Westminster entered a specially constructed hydroplane, equipped with a 400-horsepower engine and the Royal Aero Club selected the Hon. Charles Stuart Rolls to represent it.

About a week before the date set for the race, the Duke of Westminster, while taking a practice spin, put his helm hard over while the hydroplane is said to have been making nearly fifty miles an hour and the boat capsized. The duke escaped drowning by virtue of prompt rescue measures of the life-saving crew stationed nearby.

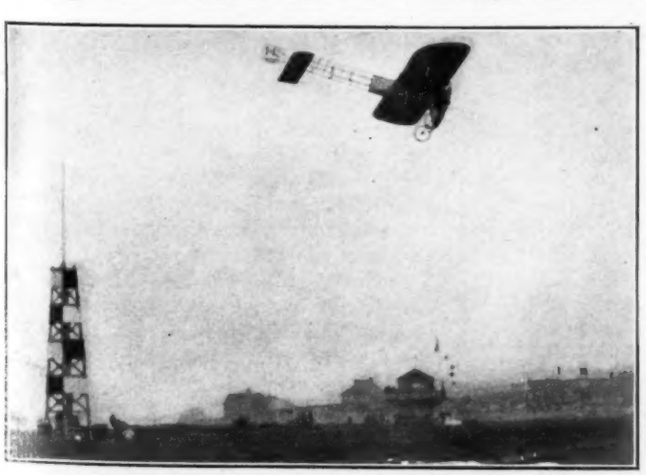
A few days later, Mr. Rolls suffered his fatal mishap in front of the Bournemouth grandstand and the contest was scratched.

The conditions under which the circle of the Needles was made were picturesque.

From the flying ground competitors had to ascend and make over water toward the Needles, a line of tall sharp rocks standing on the Eastern extremity of the Isle of Wight. Circling the lighthouse there, they had to return and alight before the grandstand. The distance over the water was just over nine miles in a straight line, making the trip just over 18 miles long, and with a turn round the aerodrome and the descent, 21 miles.

Morane rose in the air one evening about six o'clock, and, having encircled the aerodrome, shot out over the sea and within six minutes was lost to sight at an altitude of over 1,000 feet. Armstrong Drexel, also on a Bleriot machine but with a 25-horsepower Anzani instead of the 50-horsepower Gnome engine which Morane employed, followed. He also flew high and vanished into the haze over the sea. Across the belt of water stretched a line of steam yachts and racing motor boats, ready to render assistance if necessary.

Just as Drexel disappeared from sight Morane came into view high in the air. Almost as soon as his mono-plane took distinct form, he shut off the engine and came to earth with a glide from an altitude of nearly 2,000 feet. He had flown very fast, and had taken only just over 25 minutes, his average speed working out at 50 miles an hour. Though Drexel had passed him as he was returning Morane had seen nothing of him. Within a quarter of an hour the American reappeared and landed in front of the stands. His speed had been only 35 1-2 miles an hour, the time he occupied being 35 1-2 minutes. Grahame White made the circle in 46 minutes.



Morane, the Blériot pilot, making a landing at Bournemouth

Twenty-five Enter Munsey Historic Tour

WASHINGTON, D. C., July 31—Five more cars were entered this week in the Munsey Historic Tour, bringing the entry list up to twenty-five. The additions were two Maxwells, entered by the United States Motor Company, a Staver-Chicago, by the Staver Carriage Company, a Stoddard-Dayton, by Leo H. Shaab, the Baltimore agent, and a Crawford by Walter Scott, of Baltimore. The entries will close at midnight, August 5, at which time it is expected more than 30 cars will be enrolled.

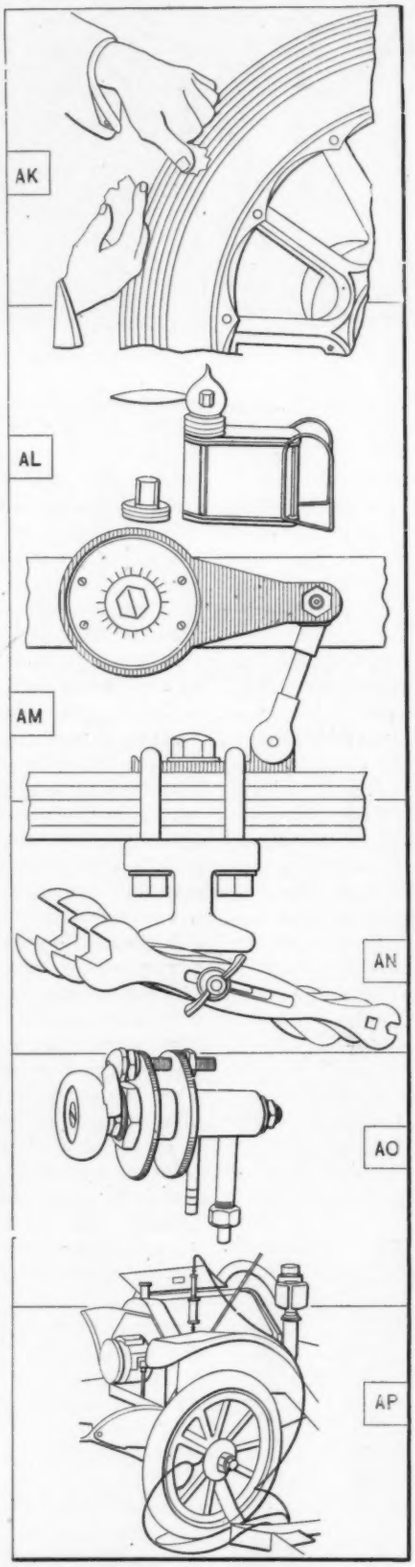
Seen in the Show Window

ON the principle that "a stitch in time saves nine," every autoist should see to it that his repair kit contains a can of Knead-it (AK), which is made by the M. & M. Manufacturing Company of Akron, O. The main merit claimed for this article is that by applying a little to a slight cut or sand blister as soon as it is discovered, the autoist prevents its growth to the point where a blow-out results. The material in kneaded between the fingers and stuffed into the cut, where it sets quickly, and seals so securely and permanently that it becomes really a part of the tire.

THE terrors of a leaky pipe or joint on the road would seem to have been minimized by the recent appearance on the market of a handy little soldering outfit, the Tinol Torch (AL), which is handled by Hess & Son, 1215 Filbert Street, Philadelphia. This is an extremely neat and compact self-acting blow-torch, burning methylated spirit and giving a hot, well-defined flame about four inches in length and sufficient for all soft soldering purposes. The solder itself, a finely granulated alloy of tin and lead, mixed with an oily flux, is in paste form. It is spread thinly on the surface of the metal to be soldered and then heated. The compound melts, the flux evaporates and the solder hardens and adheres closely to the metal.

THE principal point of merit in the Martin Shock Absorber (AM), manufactured by the company of the same name at 926 Central Avenue, Los Angeles, Cal., is that it acts only on the rebound of the springs. The spider is bolted to the car frame and carries with it all parts of the absorber except the ring and the arm which is integral therewith. This arm is linked to the axle by a connecting rod provided with ball-and-socket joint. The downward movement of the car body revolves the ring to the right. Revolution of the ring in the opposite direction through the rising of the car body causes the toggle bars to straighten, thus expanding the brake shoes against the ring. The absorber is packed in hard oil and needs no additional lubrication.

UTILIZATION of space in the tool kit, under the conditions of body designing which are fast taking shape, is a factor well worth considering. A means to this end is the Ronson Wrench (AN), made by the Ronson Specialty Company, 7-15 Mulberry Street, Newark, N. J. Weighing but half a pound, and but six inches long when closed, and half an inch thick, this handy combination tool—it gives nine wrenches in one—can be carried in a side pocket if need be. Once set, the turning of an individual wrench is impossible. It can be also taken apart, and each wrench used separat ly.



(AK)—"Knead-it" Tire Seal
(AL)—Tinol Soldering Torch
(AM)—Martin Shock Absorber
(AN)—Ronson Combination Wrench
(AO)—Presto Auto Lighter
(AP)—Skinner Automatic Pump

PHYSICIANS and car owners whose business necessitates much night driving will appreciate the advantages of such a handy little dashboard accessory as the Presto Auto Lighter (AO), marketed by the Motor Car Sales Company, Motor Mart, Boston, Mass. Without leaving his seat the driver, by one turn of a switch, creates the spark and at the same time turns on the acetylene gas. In the matter of economy the lighter is especially noteworthy. The average driver at night allows his headlights to remain burning, no matter how long the stop, rather than bother about turning off the gas and relighting his lamps when ready to go on his way. With his car equipped with this lighter he will turn off his lights at each stop, no matter how short, the saving effected being considerable in the aggregate.

LET the engine do the work—that is the slogan of the ease-loving autoist. And in the matter of inflating tires this is an easy proposition with the aid of the Skinner Automatic Tire Pump (AP), made by Skinner & Skinner Company, 1716 Michigan Avenue, Chicago, Ill. All that it is necessary to do is to remove one spark plug, screw the connection into the spark plug hole, run the engine two or three minutes on low throttle, and the tire is hard and round. The pump can be attached to any size of motor, and it is not necessary to race the engine to obtain a high pressure.

THE Racine Auto Tire Company, of Racine, are putting out what they call the Racine "Horseshoe" Tires, and claim to be the only manufacturers making a leather tire with a perfectly intact all-leather exterior. These tires are composed of four thicknesses of chrome-tanned leather vulcanized together and to a specially constructed carcass having a rubber bead of standard size. The manufacturers maintain that tests have proven that it requires about 1,000 pounds pressure to puncture one thickness of chrome-tanned leather. In the making of these tires four thicknesses of leather are used, each inseparably joined to another and the four layers vulcanized to the inner carcass.